

Yorkshire Neonatal Network Intubation Teaching Guide

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Introduction

Neonatal tracheal intubation requires training and experience in order for it to be performed safely and to minimise complications. It also is one of the core skills for paediatric trainees and as such requires that trainees are taught regularly throughout their training at a level appropriate to their experience and professional development requirements.

Aims of the Yorkshire Neonatal teaching Guide:

- To support and enhance teaching currently provided by trainers within the Yorkshire Neonatal Network
- To facilitate regular teaching, training and supervision of staff involved in intubation.
- To facilitate consistent teaching across the network

- To be used in conjunction with the Yorkshire Neonatal Network Intubation Good Practice guideline, or local policies that have been established based on this framework.

In this teaching guide a ► denotes specific points for trainers to discuss.

Who should train?

- Practitioners, who are themselves competent in intubation
- Practitioners with current and ongoing experience of intubation.

Who should be trained and supervised?

- All practitioners involved in the resuscitation or the care of newborn babies *and* whose role is to intubate when clinical need arises.
- All practitioners who intubate but who are not fully competent and experienced in intubation must be supervised *directly* by a competent practitioner (a more senior doctor or an ANNP as appropriate). Supervisors should assist if needed, and provide constructive feedback.

Where should training take place?

- **During elective intubation.**

Many of the principles also apply in an emergency situation and trainers should highlight where practices may differ.

- **Emergency intubations**

- Emergency intubations may offer training opportunities for operators already competent in elective intubation but teaching should not delay resuscitation procedures.

- **Classroom setting**

- By local arrangement
- Clinical Skills Courses

The Yorkshire Neonatal network aims to support classroom teaching across the network through half or full day Clinical Skills courses at various hospital sites throughout the year. These courses provide in depth teaching of a variety of neonatal practical procedures including intubation. Access to these training days is through junior doctor induction and the STEPS programme but staff from other sites can usually be included.

Details of clinical skills training are available from the Yorkshire Neonatal Network website www.yorkshireneonatalnetwork.org.uk.

How often is training required?

- All neonatal units should provide training for staff carrying out neonatal intubation.
- This should occur annually at a minimum and more frequently if staff rotate more often.
- Basic intubation training should be included in induction for doctors at ST1-3 level with more detailed training offered through the STEPS programme.
- Staff working on middle grade rotas should as a minimum receive assessment; feedback and teaching as practical opportunities arise.
- Where a middle grade trainee requires further support this can be offered through structured teaching sessions.
- All trainees should be assessed in their skills regularly and keep a record of these assessments [see elective intubation assessment proforma]

Indications for Intubation

There are a large number of clinical indications for a baby to require intubation.¹ It is important to establish the urgency with which intubation is required as this will determine who should intubate the baby and whether induction drugs are appropriate.

- ▶ The aim of all intubations is to provide a baby with an open, secure airway to support respiration or give surfactant whilst minimising avoidable hypoxia.

Table 1: Indications for intubation

Emergency	Elective
Failure of mask airway control	Prematurity
Difficult airway abnormalities	Instillation of surfactant
Diaphragmatic hernia	Respiratory insufficiency
Prolonged resuscitation	Unstable airway
Premature delivery	Endotracheal tube change
	Prolonged ventilation

Adapted from Wyllie, J.P. (2008) Neonatal endotracheal intubation. Arch Dis Child Educ Pract Ed. 93: 44-49.

Link to full text article





<http://ep.bmj.com/cgi/content/full/93/2/44?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=wyllie&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&volume=93&resourcetype=HWCIT>






Equipment and Drugs

Below is a list of the equipment required for a well-planned elective intubation. It is accepted that a complete set of equipment may not be available in the emergency setting though items listed as essential should be the minimum available.

► During classroom teaching, discuss all the equipment required.

Table 2: Equipment for intubation

Equipment	Essential	Desirable	Teaching points
Monitoring	Pulse oximeter Stethoscope	Heart rate	► Heart rate may usually be derived from the pulse oximeter reading. 
Gas Source	500ml self – inflating bag-valve-mask system with reservoir bag	Pressure limited piped gas system with “T piece” connector and positive end expiratory pressure valve	► A “T piece” system such as the Neopuff [®] or Tom thumb is the desirable choice of gas source as there is risk of generating inflation pressures greater than 40 KPa with a self-inflating bag-valve-mask. 
Gas	Oxygen	Air / oxygen blender with oxygen concentration analyser in situ	► Intubation should ideally not be attempted until saturations are normal. Hyperoxia is harmful and should be avoided by reducing the concentration of oxygen used.
Suction	Yankauer sucker Size 10 suction catheter		► Use suction pressure of 10 Kpa
Manual ventilation	Face mask - Round soft silicone Laerdal masks (or similar) – size 00, 0/1 and 2	Guedel airways sizes 0, 00 (5-6 cm)	
Intubation	2 working laryngoscopes with size 0 & 00 straight blade (Wisconsin blade)		

	Endotracheal tubes Sizes 2.5mm – 4mm		<p>▶ Smiths Portex[®] silicone endotracheal tubes are stiffer but long-term ventilation may be better with an ivory tube. Ivory tubes also have a larger external diameter and may reduce leak around the ETT</p> 
	Introducer (lubricated with aqua gel)		 <p>▶ Introducers should be removed from size 2.5 mm tracheal tubes with care, as it is possible to strip the plastic coating. Saline is less effective as a lubricant but all introducers should be lubricated before use.</p>
	Fixation device e.g. Neofit [®]		 <p>▶ Home made fixation devices or stitching of endotracheal tubes are not recommended</p>
		End tidal CO2 detector e.g. Pedicap [®]	 <p>▶ End tidal CO2 detectors should be used with caution in babies <1000g or with circulatory arrest</p>
		Magill's forceps	
Drugs	Sedative and analgesic Muscle relaxant (see intubation guideline for suggested drugs)		▶ Only for elective or semi elective intubation when intubation is not for resuscitation e.g. collapsed apnoeic baby or at delivery
Additional desirable equipment			
	Nasogastric tube		Aspirate prior to intubation and if baby undergoes prolonged efforts at manual ventilation
	Spare batteries		Check the laryngoscope bulb is very bright
	Scissors		

Emergency Vs Elective Intubation

Emergency

- When rapid control of an inadequate airway is required
- Ensure all steps have been taken to attempt to move to a semi – elective intubation e.g. by using effective mask ventilation
- Use of sedation is usually inappropriate and not required if baby is unconscious
- Aim to maintain sterility of equipment as far as possible.

Elective / Semi elective

- Use sedation preferably with a muscle relaxant prior to intubation
- In ETT changes, in order to minimise the time unintubated, leave the old tube in situ until oral secretions have been cleared and the new ETT is held in the oropharynx ready to be inserted.
- Keep physiological parameters as close to “normal” as possible. i.e. HR >100 and O2 saturations within the target range
- Maintain sterility of equipment

Preparation of patient

- Practitioners inexperienced at intubation should use mask ventilation until adequate help arrives assuming heart rate is maintained >100 beats/minute and oxygen saturation levels are stable.
- Prepare patient and environment prior to disturbance of an existing ETT or administration of analgesic and muscle relaxant drugs.
- Check monitoring is working and cannula is in situ and flushing
- Take steps to ensure the baby does not get cold during the procedure especially those nursed in incubators – use woolly hat and covers as a minimum
- Remove all other bedding and nesting from around the baby’s head and neck area.
- Give medication for sedation, analgesia and muscle relaxation only once all equipment and staff are ready.

Oral Vs Nasal Intubation

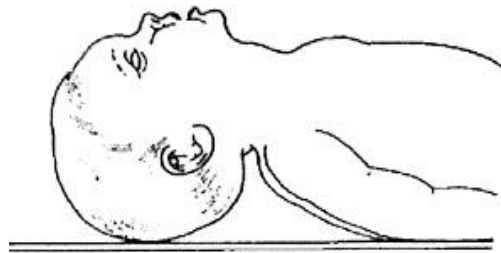
The route chosen will depend on:

- Emergency intubations
 - Oral route is quicker and should be used in an emergency
- Experience of the operator
 - Oral route may result in less trauma
- The need for long term ventilation
 - Nasal route may permit better fixation with less tube movement²
 - Long term oral placement may be associated with palatal grooving though this resolves with time³
- Unit practice

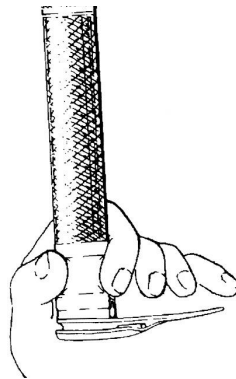
Steps for Oral Intubation

Positioning of the baby

- Incubator side should be down and the baby turned 90 degrees with head close to the edge of the mattress.
- Ensure the surface is flat and firm and elevated to a suitable height
- Keep baby's head in the midline with only a small degree of extension
- Over extension is a common mistake that moves the larynx anteriorly and makes visualisation difficult.



- Aspirate contents of stomach prior to procedure
- Hold laryngoscope in the left hand between the thumb anteriorly and the index and middle fingers posteriorly.

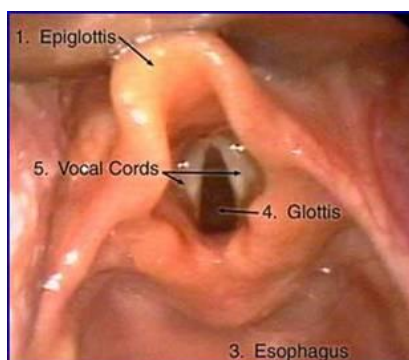


Inserting the laryngoscope

- Open the mouth with your finger.
- Insert the laryngoscope blade gently taking care not to damage the gums (placing the finger of your right hand on the upper gum can protect it)
- Move the blade along the right side of the mouth moving the tongue to the left
- Move the tip of the blade to the base of the tongue and clear any oral secretions to visualise the epiglottis
- Bring the tip of the blade to rest over the epiglottis

Visualising the Vocal Cords

- Lift the entire blade forward to bring the cords into view behind the epiglottis.
- Do not lever the blade against the gums as this will reduce the visual field and make intubation more difficult
- In small babies it is possible to apply external pressure from 5th finger on the left hand and may help to bring the vocal cords into view. This may need to be performed by a helper in bigger babies.
- If the vocal cords do not come into view, the blade may be in beyond the larynx. Pull the laryngoscope back gradually until they are seen.



Intubation

- An endotracheal tube with lubricated introducer should be brought in from the right side of the mouth in order to not obscure the view.
- Advance the tube through the cords when open until the black mark is seen to pass just below the cords.
- If the cords are together wait for them to open. DO NOT try and force the tube through.
- If the endotracheal tube appears not to pass beyond open cords try rotating the tube gently by 45-90 degrees to alter the angle of the bevel in relation to the anterior tracheal wall

Steps for Nasal Intubation

Positioning of the baby

Inserting the laryngoscope



As for oral intubation

- Select a soft endotracheal tube (e.g. ivory Portex[®] tube)
- Before inserting the laryngoscope pass the endotracheal tube with the bevel facing up directly backwards (90 degrees to the upper lip) through the nostril, into the oropharynx.
- Insert the laryngoscope to the cords.
- Advance the endotracheal tube until the end is visible in the oro-pharynx.
- Using the magill's forceps, grasp the endotracheal tube behind its tip and lift it into the tracheal opening.

- The ETT may be either “fed” by small pushes from the magill’s forceps into the trachea or gentle pressure from the nose may assist to pass it between the cords

Confirmation of Endotracheal intubation

- Once intubated the tube should be steadied in position and the introducer gently removed.
- ▶ This should be done with caution in smaller tubes as excessive speed or friction may cause the plastic to strip from the wire. The risk of this is minimised with lubrication.
- Attach an end tidal CO2 detector (e.g. Pedicap®) to the endotracheal tube; connect to a T piece or bag valve mask and ventilate gently.
- ▶ Poor or absent pulmonary blood flow may give false negative results but in practice correct placement will be identified in nearly all patients who are not in cardiac arrest. Up to 6 breaths may be needed before a colour change is seen.

Table 3 shows the methods of confirmation of tube position that are effective in combination and table 4 how to ensure the endotracheal tube is at the correct length.

Table 3: Confirmation of Endotracheal tube position	
Direct confirmation	<ul style="list-style-type: none"> • The operator observed the endotracheal tube passing through the cords • Positive colour change from an end tidal CO2 detector.
Secondary confirmation	<ul style="list-style-type: none"> • Observing symmetrical chest movement (although this may not be apparent in pre-terms soon after birth) • Improvement in heart rate and oxygen saturations or maintenance of acceptable parameters

Table 4: Length of endotracheal tube			
<ul style="list-style-type: none"> • Ensure the ETT is approximately the right length 			
Weight (kg)	Gestation	Length (cm) Oral	Length (cm) nasal
0.6	24-26	6.0	7.0
1.0	27-29	7.0	8.0
1.5	30-31	7.5	8.5
2.0	33	8.0	9.5
2.5	35	8.5	10
3.0	>37 wks	9.0-9.5	10.5-11
<ul style="list-style-type: none"> • Auscultate each side of the chest in the axillae for equal air entry. • Perform a CXR – the tip of the ETT should be at the level of the 1st – 2nd thoracic vertebrae and 1-2 cm above the carina 			

Securing the Endotracheal tube in position

- ▶ It is at this point in intubation where a successfully placed endotracheal tube can easily be dislodged. One operator should be solely responsible for ensuring the tube is steadied against the baby's lower lip whilst assistants attach the holder e.g. Neofit®.
- Once the endotracheal tube is secured in the holder, recheck the apparent endotracheal length.

Complications of Intubation

- ▶ A discussion about possible complications should complete any intubation training session focussing particularly on any which may have occurred e.g. reflex bradycardia

Complications of Intubation
Reflex bradycardia as tracheal tube inserted
Trauma or perforation of trachea, pharynx or oesophagus
Intubation of main stem bronchus (usually right)
Laryngeal oedema
Respiratory infection
Longterm intubation
• Palatal grooves (oral)
• Erosion of nares or septum (nasal)
• Subglottic stenosis (oral or nasal)
Post-extubation atelectasis
Accidental extubation

References

1. Wyllie, J.P. (2008) Neonatal endotracheal intubation. Arch Dis Child Educ Pract Ed. 93: 44-49.

Appendix 1

Elective Intubation

See notes on following page. Tasks marked with a * are essential to achieving a level of independent competence

Name:

Date:

Assessor:

	Task	Not Done	Inadequate	Completed correctly	Comment / Areas to improve
1*	Checks suitable staff available and prepares correct equipment				
2	Places baby on suitable surface and checks adequate monitoring				
3	Empties stomach by aspirating NGT				
4	Knows correct dosage/Kg body weight of intubation drugs				
5	Correct pre oxygenation of patient				
6	Maintains correct head position				
7	Correct size, positioning and hold of face mask				
8*	Achieves adequate chest movement				
9	Achieves adequate oxygen saturation				
10*	Correct use of laryngoscope				
11	Correct use of cricoid pressure if required				
12*	Inserts ETT gently through cords				
13	Maintains correct head position during intubation				
14	Returns to manual ventilation after 30 seconds				
15	Maintains adequate oxygenation throughout				
16*	Ensures ETT is correctly positioned				
17	Requests CXR if appropriate				
Documentation					
18	Documents procedure in notes				
19	Includes note on ventilation parameters post intubation				

Overall Performance			
4	3	2	1
Competent unsupervised. Can deal with complications	Able to perform procedure. May need supervision if complications.	Able to perform procedure under supervision.	Unable to perform entire procedure under supervision

Signature of assessor

Trainers Notes - Intubation assessment

This form is designed to provide a constructive detailed feedback of technical competence of the whole procedure of neonatal intubation.

The points below correspond to the numbered tasks on the assessment sheet.

1. Staff and equipment

The choice of staff can be made by the trainee and can include any combination of staff who normally assist with intubation procedures. Below is a list of the basic equipment required but additional may be added according to Unit policy.

Self inflating bag +/- neopuff set to appropriate pressure

Two sizes of face mask

2 X laryngoscopes

Suction catheters and Yankauer

ETTs X 3 of appropriate size and length

Introducer (appropriately placed in ETT if used)

Method to fix tube once in

Stethoscope

(Magills forceps)

Monitors

2. Surface and monitors

Platform or incubator according to Unit policy. Basic requirement of O2 saturation monitor which includes separate ECG monitor.

4. Prescription of premedication

Trainee must demonstrate up to date knowledge of current drug protocols for premedication.

Prescription can be verbal or written initially with correct documentation completed immediately after procedure

6. Correct head position

Using towel roll for shoulders if necessary

15. Oxygen saturation

Intubation must not be delayed because of poor reading of saturation monitors once procedure started.

Clinical judgement must be used by experienced assessor/assistant as to what constitutes "adequate" saturation levels.

10. Use of laryngoscope

Holds laryngoscope in left hand and inserts correctly into baby's mouth. Any actions *likely* to cause trauma to an infants gums must be included as "inadequate" and any resulting trauma as "incorrect"

11. Cricoid pressure

A trainee may ask an assistant to do this.

14. Manual ventilaton after 30 seconds if intubation unsuccessful

The trainee must either request someone to time the procedure or return to manual ventilation themselves at around 30 seconds if intubation not achieved at first attempt.

15. Oxygenation throughout

It can be accepted that there may be a small drop in saturation levels during intubation. The assessor must make a judgement of suitable levels according to clinical state of baby.

16. ETT position

Trainee must check for chest movement, adequate O2 saturations and auscultation in axillae and over stomach and use of CO2 detector where available.