3. What would you do differently when preparing for resuscitation or ventilating a newborn in our next scenario?

4. Give me an example of how you used at least one of the NRP Key Behavioral Skills.

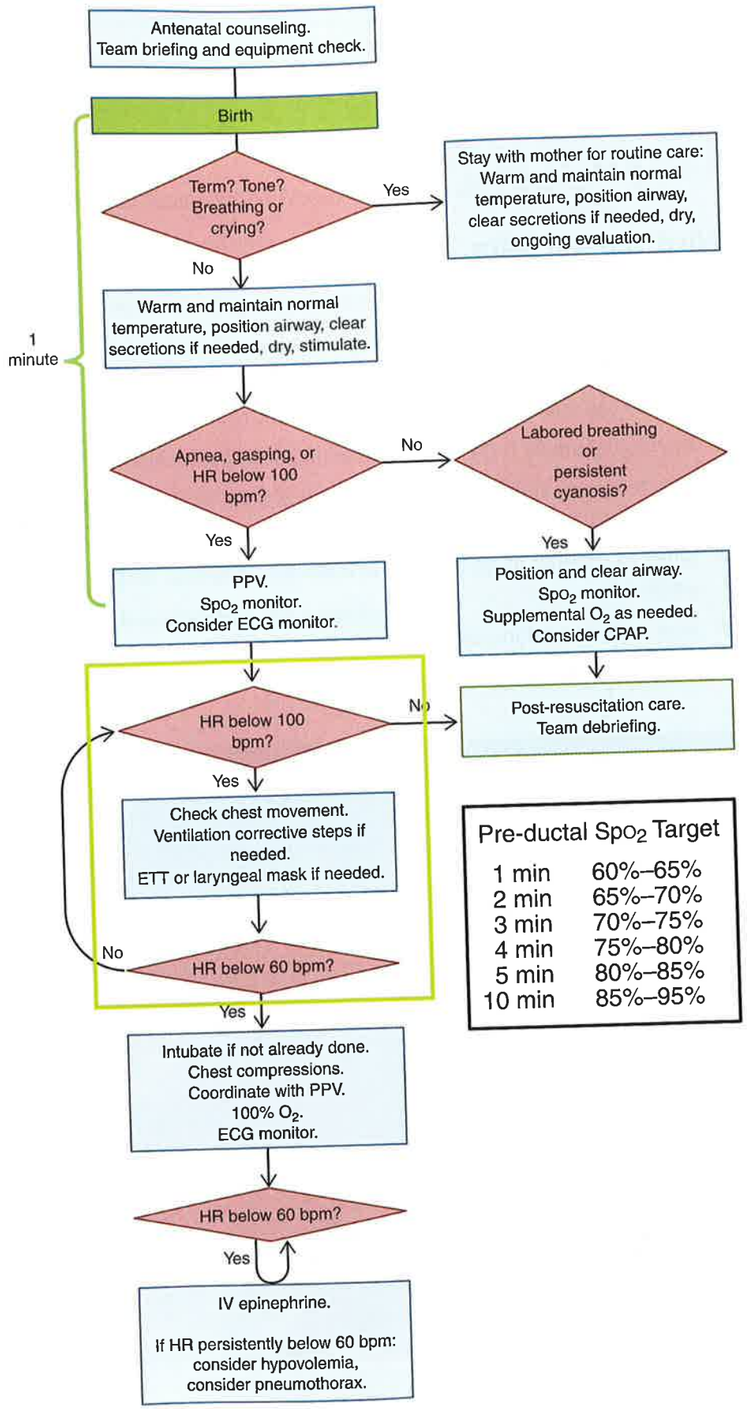
Neonatal Resuscitation Program Key Behavioral Skills

- Know your environment.
- Use available information.
- Anticipate and plan.
- Clearly identify a team leader.
- Communicate effectively.
- Delegate workload optimally.
- Allocate attention wisely.
- Use available resources.
- Call for additional help when needed.
- Maintain professional behavior.

Alternative Airways: Endotracheal Tubes and Laryngeal Masks

What you will learn

- The indications for an alternative airway during resuscitation
- How to select and prepare the equipment for endotracheal intubation
- How to use a laryngoscope to insert an endotracheal tube
- How to determine if the endotracheal tube is in the trachea
- How to use an endotracheal tube to suction thick secretions from the trachea
- When to consider using a laryngeal mask for positive-pressure ventilation
- How to place a laryngeal mask



Case 1: Resuscitation with positive-pressure ventilation using an endotracheal tube

A 25-year-old primiparous woman at 37 weeks' gestation is in active labor complicated by maternal fever and fetal tachycardia. Your resuscitation team is called to attend the anticipated vaginal birth. You ask the obstetric provider about perinatal risk factors and complete a pre-resuscitation team briefing. Shortly afterward, a baby girl is born. The obstetrician holds her in a dry blanket and gently stimulates her to breathe, but she remains limp and apneic. The umbilical cord is clamped and cut and she is moved to the radiant warmer where you complete the initial steps of newborn care. After completing the initial steps, she is still apneic and you start positive-pressure ventilation (PPV) while an assistant places a pulse oximeter on her right hand. Her heart rate is 50 beats per minute (bpm) and not increasing. You observe that the chest is not moving with PPV breaths and begin the ventilation corrective steps. After the first 5 corrective steps, the chest is still not moving consistently and your assistant reports that her heart rate is not improving. You decide that an alternative airway should be inserted to improve the effectiveness of PPV.

An assistant holds a 3.5-mm endotracheal tube, provides cricoid pressure, and monitors the procedure time while a qualified provider uses a laryngoscope with a size-1 blade to insert the endotracheal tube. A CO_2 detector is placed on the tube, ventilation is resumed, and the detector turns yellow, indicating that the tube is in the trachea. The baby's chest is moving and her heart rate rapidly increases. Based on the nasal-tragus length (NTL) measurement, the endotracheal tube is held with the 8-cm marking adjacent to the lip. Breath sounds are equal in both axillae, the tube is secured, and PPV continues. You adjust the oxygen concentration based on pulse oximetry. The baby still has poor tone and irregular respiratory effort. You quickly update her parents and transfer her to the nursery for a chest x-ray and additional care. Shortly afterward, your resuscitation team conducts a debriefing to discuss preparation, teamwork, and communication.

What alternative airways are available for neonatal resuscitation?

Endotracheal tubes

Endotracheal tubes (Figure 5.1) are thin tubes that are inserted through the glottis, between the vocal cords, and advanced into the trachea. Although digital intubation using only the operator's

Figure 5.1. Endotracheal tubes (size 2.5, 3.0, 3.5)

Figure 5.2. Laryngoscope

Figure 5.3. Examples of neonatal laryngeal masks (supraglottic devices)

finger has been described, endotracheal intubation typically requires the use of a lighted instrument (laryngoscope, [Figure 5.2]) to visualize the larynx and guide the placement of the tube between the vocal cords.

Laryngeal masks

A laryngeal mask is a small mask attached to an airway tube that is inserted into the mouth and advanced until the mask covers the glottis (Figure 5.3). An endotracheal tube is advanced through the glottis, but the laryngeal mask remains above the glottis, which is why the laryngeal mask is called a supraglottic airway device. The laryngeal mask is an effective alternative when attempts at face-mask ventilation and intubation are unsuccessful. Placement of a laryngeal mask does not require visualization of the larynx or the use of an instrument for insertion. Its use in preterm newborns is limited, in part because the smallest available size may be too large for smaller newborns.

When should an alternative airway be considered?

Insertion of an endotracheal tube or a laryngeal mask should be considered in the following circumstances:

- If PPV with a face mask does not result in clinical improvement, an endotracheal tube or laryngeal mask is strongly recommended to improve ventilation efficacy.
- If PPV lasts for more than a few minutes, an endotracheal tube or a laryngeal mask may improve the efficacy and ease of assisted ventilation.

Insertion of an endotracheal tube is strongly recommended in the following circumstances:

- If chest compressions are necessary, an endotracheal tube will maximize the efficacy of each positive-pressure breath and allow the compressor to give compressions from the head of the bed. If intubation is not successful or feasible, a laryngeal mask may be used.
- An endotracheal tube provides the most reliable airway access in special circumstances, such as (1) stabilization of a newborn with a suspected diaphragmatic hernia, (2) for surfactant administration, and (3) for direct tracheal suction if the airway is obstructed by thick secretions.

What are the important anatomic landmarks in the neonatal airway?

The anatomic landmarks are labeled in Figures 5.4 and 5.5.

1. **Esophagus:** The passageway extending from the throat to the stomach
2. **Epiglottis:** The lid-like structure overhanging the glottis
3. **Vallecula:** The pouch formed by the base of the tongue and the epiglottis
4. **Larynx:** Portion of the airway connecting the pharynx and trachea
5. **Glottis:** The opening of the larynx leading to the trachea, flanked by the vocal cords
6. **Vocal cords:** Mucous membrane-covered ligaments on both sides of the glottis
7. **Thyroid and cricoid cartilage:** Lower portion of the cartilage protecting the larynx
8. **Trachea:** Portion of the airway extending from the larynx to the carina
9. **Carina:** Where the trachea branches into the 2 main bronchi
10. **Main bronchi:** The 2 air passageways leading from the trachea to the lungs

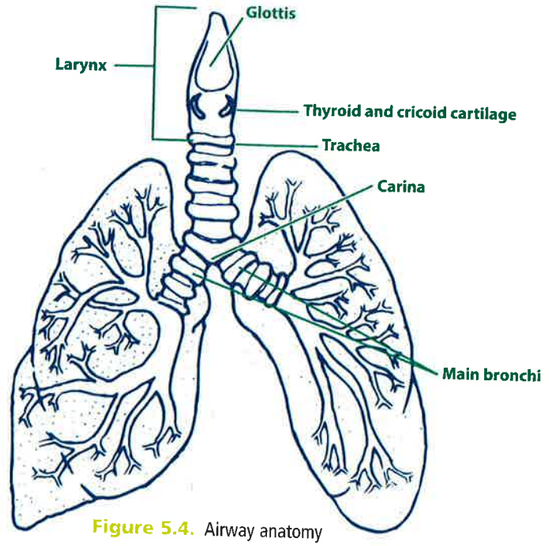


Figure 5.4. Airway anatomy

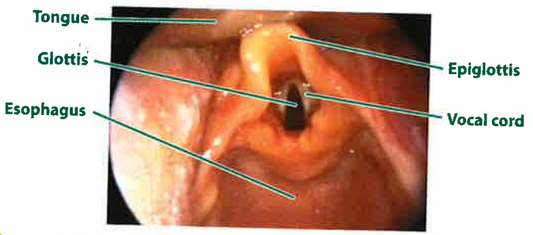


Figure 5.5. Laryngoscopic view of vocal cords and surrounding structures

What equipment should be available for airway insertion?

The equipment necessary to place an alternative airway should be kept together and readily accessible. It is important to anticipate the need for airway insertion and prepare the equipment before a high-risk delivery.

Each delivery room, nursery, and emergency department should have at least one complete set of the following items (Figure 5.6):

Figure 5.6. Neonatal airway equipment and supplies (supplies removed from sterile packaging for demonstration purposes)

1. Laryngoscope handle with an extra set of batteries and extra bulbs
2. Laryngoscope blades: No. 1 (term newborn), No. 0 (preterm newborn), No. 00 *(optional for very preterm newborn)*. Straight blades (Miller), rather than curved blades (Macintosh), are preferred
3. Endotracheal tubes with internal diameters of 2.5, 3.0, and 3.5 mm
4. Stylet (*optional*) that fits into the tracheal tube
5. CO_2 monitor or detector
6. Suction setup with suction catheters: size 10F or 12F (for suctioning the pharynx), size 8F, and either size 5F or 6F (for suctioning endotracheal tubes of various sizes)
7. Waterproof adhesive tape (1/2 or 3/4 inch), or other tube-securing device
8. Measuring tape and/or endotracheal tube insertion depth table
9. Scissors
10. Meconium aspirator
11. Stethoscope (with neonatal head)

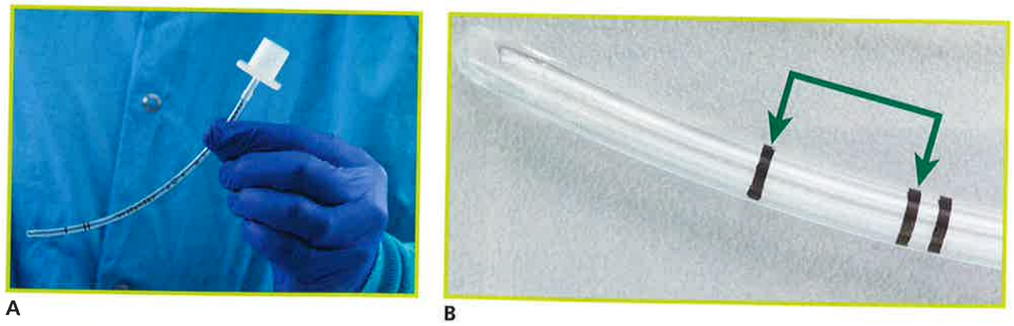
12. Positive-pressure ventilation device (bag or T-piece resuscitator) and tubing for blended air and oxygen
13. Pulse oximeter, sensor and cover
14. Laryngeal mask (size 1) or other supraglottic device and 5-mL syringe.

Airway placement should be performed as a clean procedure. All supplies should be protected from contamination by being opened, assembled, and placed back in their packaging until just before use. The laryngoscope blades and handle should be cleaned, following your hospital's procedures, after each use.

Endotracheal Intubation

What type of endotracheal tube should be used?

The endotracheal tube should have a uniform diameter throughout the length of the tube (Figure 5.7A). Tapered and cuffed tubes are not recommended for neonatal resuscitation. Endotracheal tubes have centimeter markings along the side measuring the distance to the tip of the tube. Many tubes will also have lines or markings (Figure 5.7B) near the tip that are intended to be a vocal cord guide. When the tube is inserted so that vocal cords are positioned between the 2 sets of lines, the tip of the tube is expected to be above the carina; however, the location and design of the lines varies considerably between manufacturers. *The vocal cord guide is only an approximation and may not reliably indicate the correct insertion depth.*



A B

Figure 5.7. Neonatal endotracheal tube with a uniform diameter (A). This tube has a vocal cord guide that is used to approximate the insertion depth (B). The tube is inserted so that the vocal cords are positioned in the space between the double line and single line (indicated by the arrows). The vocal cord guide is only an approximation and may not reliably predict the correct insertion depth.

How do you prepare the endotracheal tube?

Select the correct size.

Endotracheal tubes are described by the size of their internal diameter (mm ID). The appropriate endotracheal tube diameter is estimated from the baby's weight or gestational age. Table 5-1 gives the recommended endotracheal tube size for various weight and gestational-age categories. Using a tube that is too small increases the resistance to air flow and the chance that it will become obstructed by secretions. Using a tube that is too large may traumatize the airway.

Table 5-1. Endotracheal tube size for babies of various weights and gestational ages

Weight (g)	Gestational Age (wks)	Endotracheal Tube Size (mm ID)
Below 1,000	Below 28	2.5
1,000-2,000	28-34	3.0
Greater than 2,000	Greater than 34	3.5

Consider using a stylet.

Many operators find it helpful to use a stylet with the endotracheal tube to provide additional rigidity and curvature (Figure 5.8). Use of a stylet is optional and depends on the operator's preference. When inserting a stylet, it is important to ensure that the tip is not protruding from either the end or side hole of the endotracheal tube. If the tip is protruding, it may cause trauma to the tissues. The stylet should be secured with a plug, or bent at the top, so that it cannot advance farther into the tube during the insertion procedure.

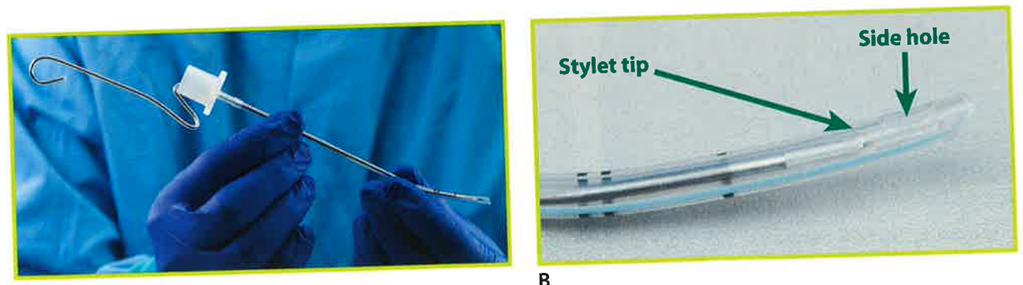


Figure 5.8. Optional stylet for increasing endotracheal tube stiffness and maintaining curvature during intubation

How do you prepare the laryngoscope and other equipment you will need?

The following steps describe how to prepare the equipment used for intubation:

1. Select the appropriate laryngoscope blade and attach it to the handle.
   a. Use a No. 1 blade for term newborns.
   b. Use a No. 0 blade for preterm newborns. Some operators may prefer to use a No. 00 blade for extremely preterm newborns.
2. Turn on the light by clicking the blade into the open position to verify that the batteries and light are working. If the light is dim or flickers, tighten or replace the bulb, insert a new battery, or replace the laryngoscope.
3. Prepare the suction equipment. Occlude the end of the suction tubing to ensure that the suction is set to 80 to 100 mm Hg. Connect a size 10F (or larger) suction catheter to remove secretions from the mouth and pharynx. Smaller suction catheters (size 8F and size 5F or 6F) should be available for removing secretions from the endotracheal tube, if necessary, after placement. Appropriate catheter sizes are listed in Table 5-2.

   A meconium aspirator can be attached to the endotracheal tube to directly suction meconium or thick secretions that obstruct the trachea. Some endotracheal tubes have an integrated suction port.
4. Prepare a PPV device with a mask to ventilate the baby, if necessary, between intubation attempts. Check the operation of the device as described in Lesson 4.
5. Place a CO_2 detector, stethoscope, measuring tape or insertion depth table, waterproof adhesive tape, and scissors (or a tube stabilizer) within reach.

Table 5-2. Suction catheter size for endotracheal tubes of various inner diameters

Endotracheal Tube Size (mm ID)	Catheter Size
2.5	5F or 6F
3.0	6F or 8F
3.5	8F

How should you position the newborn for intubation?

Place the baby's head in the midline, the neck slightly extended, and the body straight. It may be helpful to place a small roll under the baby's shoulders to maintain slight neck extension. This "sniffing" position aligns the trachea for optimal viewing by allowing a straight line of sight into the glottis once the laryngoscope has been properly placed. Your assistant should help to maintain good positioning throughout the procedure.

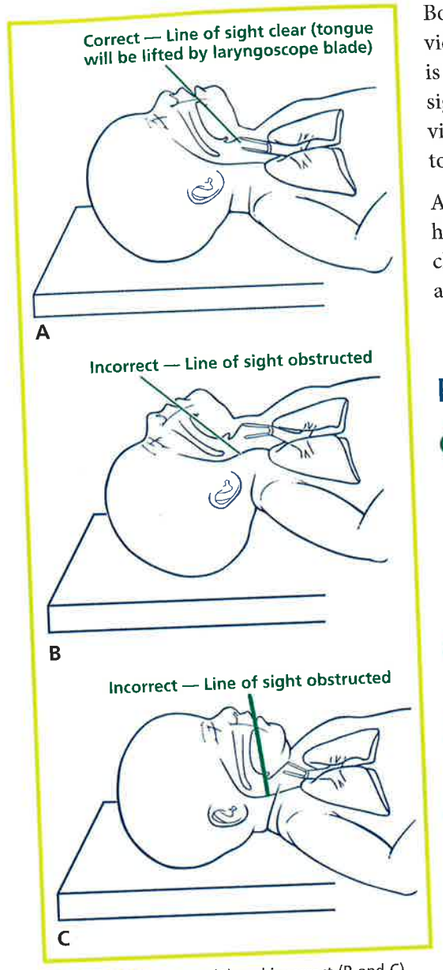


Figure 5.9. Correct (A) and incorrect (B and C) positioning for intubation

Both overextension and flexion of the neck will obstruct your view of the airway. If the shoulder roll is too large or the neck is overextended, the glottis will be raised above your line of sight. If the neck is flexed toward the chest, you will be viewing the posterior pharynx and will not be able to visualize the glottis (Figure 5.9).

Adjust the height of the bed, if possible, so that the baby's head is level with the operator's upper abdomen or lower chest to bring the head closer to the operator's eye level and improve her view of the airway.

Review

1. A newborn has been receiving face-mask ventilation, but is not improving. Despite performing the first 5 ventilation corrective steps, the heart rate is not rising and there is poor chest movement. An alternative airway, such as an endotracheal tube or laryngeal mask, (should)/(should not) be inserted immediately.

2. For babies weighing less than 1,000 g, the endotracheal tube size should be (2.5 mm)/(3.5 mm).

3. If using a stylet, the tip of the stylet (must)/(must not) extend beyond the endotracheal tube's side and end holes.

4. The preferred laryngoscope blade size for use in a term newborn is (No. 1)/(No. 0).

5. The vocal cord guide on an endotracheal tube (does)/(does not) reliably predict the correct insertion depth.

Answers

1. An alternative airway, such as an endotracheal tube or a laryngeal mask, should be inserted immediately.

2. For babies weighing less than 1,000 g, the endotracheal tube size should be 2.5 mm.

3. The tip of the stylet must not extend beyond the endotracheal tube's side and end holes.

4. The preferred laryngoscope blade size for use in a term newborn is No. 1.

5. The vocal cord guide on an endotracheal tube does not reliably predict the correct insertion depth.

Figure 5.10. Hold the laryngoscope in your left hand.

How do you hold the laryngoscope?

Always hold the laryngoscope in your ***left*** hand with your thumb resting on the upper surface of the laryngoscope handle and the blade pointing away from you (Figure 5.10). The laryngoscope is designed to be held in the left hand by both right- and left-handed users. If held in the right hand, your view through the open, curved portion of the blade will be obstructed.

How do you perform the intubation procedure?

The steps for tracheal intubation are briefly described as follows; however, proficiency requires considerable supervision and practice. Even if you are not performing the procedure, it is helpful to understand the steps so you can effectively assist the operator.

Get ready to insert the laryngoscope.

1. Correctly position the baby. If possible, adjust the height of the warmer as needed. You may stabilize the baby's head with your right hand (Figure 5.11) while a team member ensures that the baby is lying straight and the head is in the "sniffing" position.

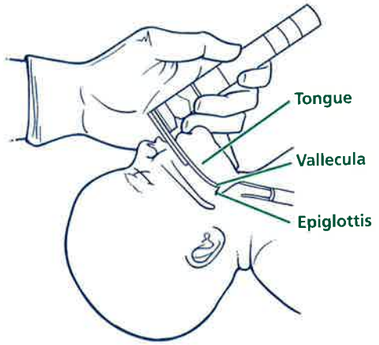
2. Use your right index finger to gently open the baby's mouth.

Figure 5.11. Positioning the baby for intubation

Insert the laryngoscope and identify key landmarks.

3. Insert the laryngoscope blade into the right side of the baby's mouth and slide the blade over the right side of the tongue toward the midline. Gently push the tongue toward the left side of the mouth and advance the blade until the tip lies just beyond the base of the tongue in the vallecula (Figure 5.12).

A



B

C

D

Figure 5.12. Insert the laryngoscope blade into the right side of mouth and slide toward the midline (A), advance the blade until the tip lies in the vallecua (B), and hold the laryngoscope in the midline (C) gently pushing the tongue toward the left side of the mouth (D) allowing you to identify landmarks.

4. Lift the entire laryngoscope in the direction that the handle is pointing, moving the tongue out of the way to expose the glottis. You may need to tilt the tip of the blade very slightly to lift the epiglottis.

   When first learning the procedure, operators have a tendency to bend their wrist, pulling the top of the handle toward themselves in a "rocking" motion against the baby's upper gum. This will not produce the desired view of the glottis and may injure the baby's lips and gums (Figure 5.13).

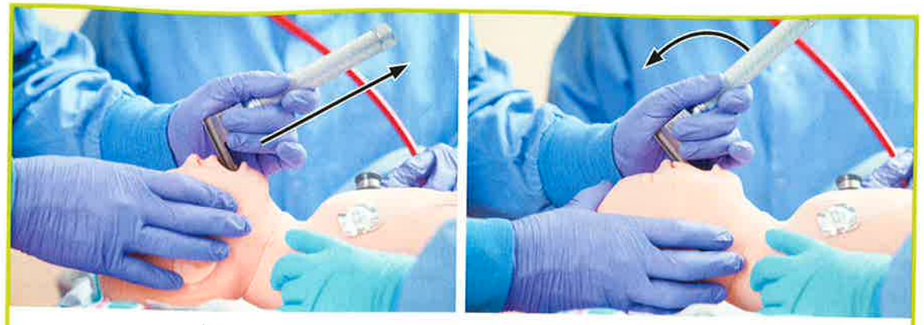


Figure 5.13. Correct (left) and incorrect (right) method for lifting the laryngoscope to expose the larynx. Lift the laryngoscope in the direction that the handle is pointed; do not rotate or "rock" the handle against the baby's upper gum.

Note: This lesson describes placing the tip of the blade in the vallecula to lift the epiglottis. In some cases, it may be necessary to use the blade tip to *gently* lift the epiglottis directly.

The glottis appears at the very top of your view as you look down the laryngoscope. An assistant can help bring the glottis into view by using his thumb and first finger to provide gentle pressure on the baby's thyroid and cricoid cartilage (Figure 5.14). The assistant should direct the pressure downward and toward the baby's right ear.

Figure 5.14. Thyroid and cricoid pressure provided by an assistant may improve visualization of the larynx. Press downward and toward the baby's right ear.

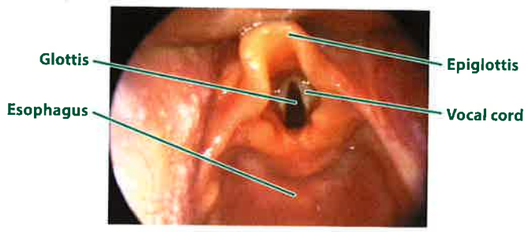


Figure 5.15. Key landmarks

5. Identify the key landmarks (Figure 5.15). If the tip of the blade is correctly positioned in the vallecula, you should see the epiglottis hanging down from the top and the vocal cords directly below. The vocal cords appear as thin vertical stripes in the shape of an inverted letter "V".

If these structures are not immediately visible, adjust the blade until the structures come into view. You may need to insert or withdraw the blade slowly to see the vocal cords (Figure 5.16).

If the blade is not inserted far enough, you will see the base of the tongue and posterior pharynx (Figure 5.17). Advance the blade slightly until the epiglottis comes into view.

If the blade is inserted too far, you will see only the esophagus (Figure 5.18) and will need to withdraw the blade slightly until the epiglottis drops down from above.

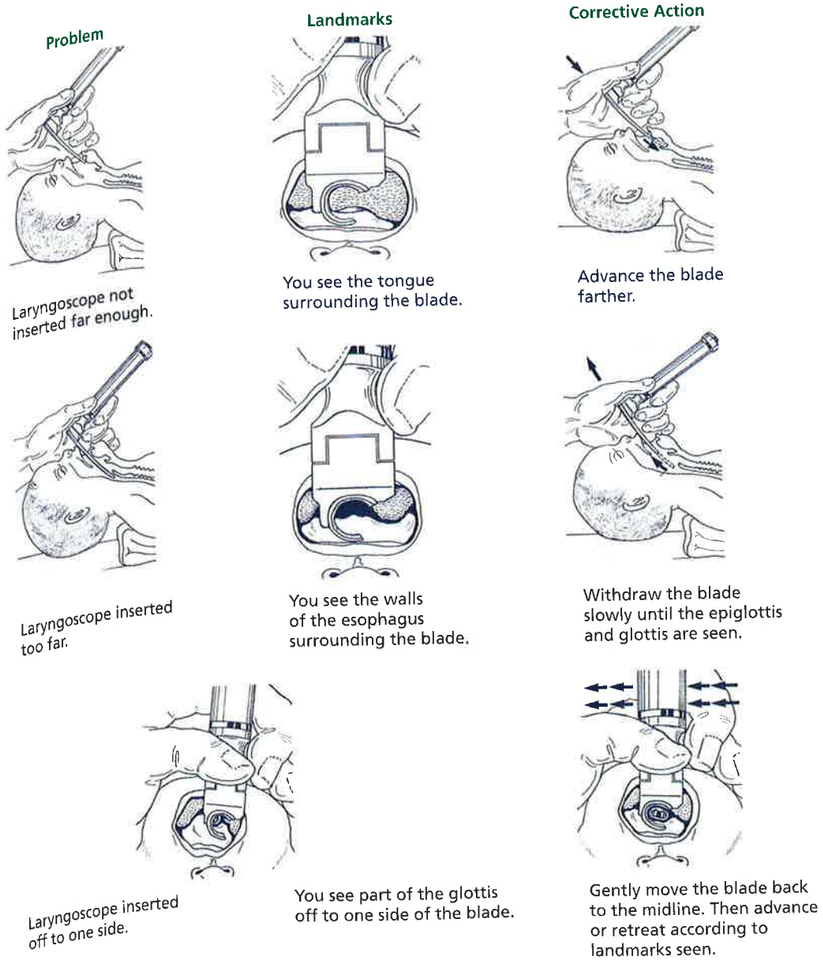


Figure 5.16. Corrective actions for poor visualization of the larynx during laryngoscopy

Figure 5.17. Laryngoscope not inserted far enough. Tongue and posterior pharynx obscure view.

Figure 5.18. Laryngoscope inserted too far. Only the esophagus is visible.

Figure 5.19. Suctioning secretions during laryngoscopy

If the anatomic landmarks are obstructed by secretions, use a size 10F or 12F catheter to remove secretions from the mouth and pharynx (Figure 5.19).

Insert the endotracheal tube.

6. Once you have identified the vocal cords, hold the laryngoscope steady, maintain your view of the vocal cords, and ask an assistant to place the endotracheal tube in your right hand. Insert the tube into the right side of the baby's mouth with the concave curve in the horizontal plane (Figure 5.20). Do not insert the tube through the laryngoscope's open channel. This will obstruct your view of the vocal cords.

After insertion, direct the tube into the hypopharynx and advance the tip toward the vocal cords. As the tip approaches the vocal cords, pivot the tube into the vertical plane so the tip is directed upward. When the

Figure 5.20. Insertion of the endotracheal tube into the right side of the mouth

vocal cords open, advance the tube until the vocal cords are positioned between the vocal cord guide lines. Your assistant may feel the tube pass beneath his fingers. Note the centimeter depth marking on the outside of the tube that aligns with the baby's upper lip.

If the vocal cords are closed, wait for them to open. Do not touch the closed cords with the tip of the tube and never try to force the tube between closed cords. If the cords do not open within 30 seconds, stop and resume ventilation with a mask until you are prepared to reattempt insertion.

Secure the endotracheal tube.

7. Use your right hand to hold the tube securely against the baby's hard palate. *Carefully remove the laryngoscope* without displacing the tube (Figure 5.21). If a stylet was used, an assistant should remove it from the endotracheal tube—again being sure that the operator is careful to hold the tube in place (Figure 5.22). Although it is important to hold the tube firmly, be careful not to squeeze the tube so tightly that the stylet cannot be removed.

Figure 5.21. Stabilize the tube against the baby's palate or cheek while carefully removing the laryngoscope.

Figure 5.22. An assistant removes the optional stylet while the operator holds the tube in place.

Ventilate through the endotracheal tube.

8. An assistant should attach a CO_2 detector and PPV device to the endotracheal tube (Figure 5.23). Having the same person hold the endotracheal tube and the PPV device may help to avoid accidental extubation. Once the PPV device is attached, begin ventilation through the tube.

Figure 5.23. Attach a CO_2 detector and PPV device to the endotracheal tube and begin ventilation.

How much time should be allowed for an intubation attempt?

The steps of intubation should be completed within approximately **30** seconds. The baby is not being ventilated during the procedure, so rapid action is essential. If the baby's vital signs worsen during the procedure (severe bradycardia or decreased oxygen saturation), it is usually preferable to stop, resume PPV with a mask, and then try again.

Repeated attempts at intubation are not advised because you will increase the likelihood of soft-tissue trauma and make subsequent airway management more difficult. If the initial attempts are unsuccessful, evaluate other options, including requesting assistance from another provider with intubation expertise (eg, anesthesiologist, emergency department physician, respiratory care practitioner, neonatal nurse practitioner), placing a laryngeal mask, or continuing face-mask ventilation.

Figure 5.24. The colorimetric CO_2 detector is a purple or blue color before detecting exhaled CO_2 (top). The detector turns yellow in the presence of exhaled CO_2 (bottom).

How do you confirm that the endotracheal tube is in the trachea?

The primary methods of confirming endotracheal tube placement within the trachea are detecting exhaled CO_2 and a rapidly rising heart rate. As soon as you insert the endotracheal tube, connect a CO_2 detector (Figure 5.23) and confirm the presence of CO_2 during exhalation. If the tube is correctly placed and you are providing effective ventilation through the tube, you should detect exhaled CO_2 within 8 to 10 positive-pressure breaths.

There are 2 types of CO_2 detectors available. Colorimetric devices change color in the presence of CO_2 (Figure 5.24). These are the most commonly used devices in the delivery room. Capnographs are electronic monitors that display the CO_2 concentration with each breath.

Can the tube be in the trachea even though CO_2 is NOT detected?

Yes, there are limitations to the use of CO_2 detectors. If the tube is placed within the trachea, but the lungs are not adequately ventilated, there may not be enough exhaled CO_2 to be detected. This may occur if the endotracheal tube or trachea are obstructed by secretions, you are not using enough ventilating pressure, or there are large bilateral pneumothoraces and the lungs are collapsed. In addition, babies with a very low heart rate or decreased cardiac function (low cardiac output) may not carry enough CO_2 to their lungs to be detected.

Can the CO_2 detector change color when the tube is NOT in the trachea?

Although uncommon, it is possible for a colorimetric CO_2 device to change color even though the tube is not in the trachea (Table 5.3). If the detector has already changed color in the package and is yellow when you remove it, the device is defective and should not be used. If epinephrine is administered through the endotracheal tube and touches the paper inside the CO_2 detector, it will permanently change the screen yellow and make the detector unusable.

Table 5-3. Colorimetric CO_2 Detector Problems

False Negative (Tube IS IN trachea but NO color change)	False Positive (Tube IS NOT in trachea but color changes)
• Inadequate ventilating pressure • Collapsed lungs • Bilateral pneumothoraces • Low heart rate • Low cardiac output	• Defective device changed color in package before use • Epinephrine contamination

What are other indicators that the tube is in the trachea?

Demonstrating *exhaled CO_2* and observing a *rapidly increasing heart rate* are the *primary methods* of confirming endotracheal tube placement within the trachea.

If the tube is positioned correctly, you should also observe

- Audible and equal breath sounds near both axillae during PPV
- Symmetrical chest movement with each breath
- Little or no air leak from the mouth during PPV
- Decreased or absent air entry over the stomach

Be cautious when interpreting breath sounds in newborns because sounds are easily transmitted. When listening to breath sounds, use a small stethoscope and place it near the axilla. A large stethoscope, or one placed near the center of the chest, may transmit sounds from the esophagus or stomach.

What do you do if you suspect that the tube is not in the trachea?

The tube is not likely to be in the trachea if the CO_2 detector does not show the presence of exhaled CO_2 within 8 to 10 breaths. In most cases, you should remove the tube, resume ventilation with a face mask, ensure that your equipment is properly prepared, ensure that the baby is optimally positioned, and then repeat the procedure. Using an endotracheal tube that is placed in the esophagus provides no ventilation to the baby's lungs and continuing to use it only delays effective ventilation.

A. Nasal septum

B. Ear tragus

C. Measuring the NTL

Figure 5.25. Measuring the NTL. Measure from the middle of the nasal septum (arrow, A) to the ear tragus (arrow, B) and add 1 cm to the measurement.

Remember that babies with a very low heart rate or decreased cardiac function may not carry enough CO_2 to their lungs to change the color on the CO_2 detector. If you believe that the tube is correctly placed in the trachea despite the lack of exhaled CO_2, you may choose to stabilize the tube, reinsert the laryngoscope, and attempt to confirm that the tube is passing between the vocal cords. This "second look" procedure can be difficult and may delay establishing effective ventilation if the tube is not correctly placed.

How deeply should the tube be inserted within the trachea?

The goal is to place the endotracheal tube tip in the middle portion of the trachea. This generally requires inserting the tube so that the tip is only 1 to 2 centimeters below the vocal cords. It is important not to insert the tube too far so that the tip touches the carina or enters a main bronchus. Two methods may be used for estimating the insertion depth. Your team should determine which method is preferred in your practice setting.

The NTL is a method that has been validated in both full-term and preterm newborns. The NTL method uses a calculation based on the distance (cm) from the baby's nasal septum to the ear tragus (Figures 5.25A, 5.25B, and 5.25C). Use a measuring tape to measure the NTL. The estimated insertion depth (cm) is NTL + 1 cm. Place the endotracheal tube so that the marking on the tube corresponding to the estimated insertion depth is adjacent to the baby's lip.

Recent studies have shown that gestational age is also an accurate predictor of the correct insertion depth (Table 5-4) and has the advantage of being known before birth. This table could be placed near the radiant warmer or with your intubation supplies.

Table 5-4. Initial endotracheal tube insertion depth ("tip to lip") for orotracheal intubation

Gestation (weeks)	Endotracheal tube insertion depth at lips (cm)	Baby's Weight (grams)
23-24	5.5	500-600
25-26	6.0	700-800
27-29	6.5	900-1000
30-32	7.0	1,100-1,400
33-34	7.5	1,500-1,800
35-37	8.0	1,900-2,400
38-40	8.5	2,500-3,100
41-43	9.0	3,200-4,200

Adapted from Kempley ST, Moreira JW, Petrone FL. Endotracheal tube length for neonatal intubation. *Resuscitation*. 2008;77(3):369-373.

Remember that both of these methods are estimates of the correct endotracheal tube depth. After placing the tube, use a stethoscope to listen for breath sounds in both axillae and over the stomach (Figure 5.26). If the tube is correctly placed, the breath sounds should be equal on both sides. If the tube is in too far, the breath sounds may be decreased on one side. Most often, if the tube is inserted too far, it will enter the right mainstem bronchus causing breath sounds to be louder on the right side and quieter on the left side. Slowly withdraw the tube while listening to the breath sounds on the quieter side. When the tube is correctly positioned, the breath sounds should improve and become equal.

A

B

Figure 5.26. Listen for equal breath sounds in both axillae (A). Breath sounds should not be audible over the stomach (B).