

## Difficult Airway in an Infant With Respiratory Failure

Cathy R. Lammers, M.D.

Sacramento, California

### OBJECTIVES

Essential components of an anesthesia consult to the ICU to evaluate an infant with respiratory failure

Preoperative preparation for a potential need for surgical airway

Anesthesia plan for direct laryngoscopy and possible tracheostomy

Subglottic stenosis: etiology, diagnosis, and treatment

Cuffed vs uncuffed endotracheal tube in pediatrics

Resuscitation of an infant with “difficult IV access”

### STEM CASE - KEY QUESTIONS

The pediatric critical care attending requests an anesthesia consult to evaluate intubation of a 6 week old with respiratory failure and possible subglottic stenosis. The term infant was transferred from a community hospital to the intensive care unit 5 days earlier with retractions, increased respiratory rate and decreased oxygen saturation.

She presented with new onset of cold symptoms and respiratory distress. She has received supportive therapy of oxygen, steroids, albuterol nebs, and racemic epinephrine. During her 5 day course she was initially admitted to the PICU for 2 days, transferred to the ward for 2 days and was readmitted to the PICU on the day of the anesthesia consult.

She has a history of a 13 day PICU admission discharged home just 8 days prior to the current admission. During her previous admission she was 8 days old (3 kg) and presented with seizures and intraventricular hemorrhage. She was intubated for 7 days. Chart review of prior admission reveals history of a “difficult intubation” in the emergency room with a 4.5 cuffed endotracheal tube.

Bedside evaluation reveals a 4 kg infant in a heliox hood with respiratory rate=42, oxygen saturation=95% , and mild retractions. She has inspiratory stridor and coarse breath sounds that are equal bilateral.

What are your recommendations for the pediatric critical care team regarding intubation of this infant?

What is the differential diagnosis of subglottic stenosis in this 5 week old?

Is a cuffed endotracheal tube appropriate in a newborn?

Four hours later the intensivist pages you and says the infant has increased respiratory distress and needs to be intubated urgently. Bedside evaluation reveals rr=64 , oxygen saturation=90%, and moderate substernal, intercostal and subcostal (abdominal) retractions.

How will you prepare to intubate the infant?

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Will you intubate the infant in the ICU or in the operating room?

The infant arrives in the operating room with respiratory rate=68 , oxygen saturation=85% , and severe retractions. Assisted ventilation with the anesthesia circuit increases oxygen saturation to 100%, retractions remain severe. She has an intravenous line in her scalp. The pediatric anesthesia attending on call arrives to assume care from the initial pediatric anesthesia attending.

What is your anesthesia plan?

Atropine 0.12 mg is given and an awake laryngoscopy is performed by the senior anesthesia resident. She has a grade one view but is unable to advance a 3.5 ETT beyond the cords. Multiple providers restrain the infant during the attempt. The scalp intravenous line is inadvertently discontinued. The infant's condition is unchanged from her initial presentation to the operating room.

How do you proceed?

After twenty minutes of assisted ventilation, two pediatric anesthesia attendings are unable to place a peripheral intravenous line.

What are your options now?

An anesthesia technician is paged to the room. He is asked to obtain an intraosseous access needle and central line kit. He returns stating that he can't find an IO needle.

What is an intraosseous needle, where can you find them in your institution? how do you place one?

What is the appropriate central line size? options for insertion sites?

While the anesthesia resident continues to maintain the airway, an attending attempts to place a femoral intravenous line. The access needle enters an artery so an arterial femoral line is placed.

What drugs can be given through a femoral arterial line? What drugs can be given through an umbilical arterial line? What drugs can be given through an IO line?

Due to 40 minutes of time trying to obtain intravenous access and continued severe retractions despite adequate oxygenation and oxygen saturations, the decision is made to again attempt to get airway better access without a venous line in place. An anesthesia attending makes three unsuccessful attempts to intubate with a 3.0, 2.5, and 2.0 ETT (with stylet) while maintaining adequate oxygen saturation with intermittent assisted mask ventilation. The otolaryngologist makes two unsuccessful attempts to intubate with a 2.0 ETT with his surgical laryngoscope. The suggestion is made that maybe administration of a muscle relaxant would facilitate the intubation.

Would you administer muscle relaxant? If so, which drug and which route? What are the pros and cons?

The decision is made to proceed to rigid bronchoscopy to facilitate tracheotomy and oxygenation/ventilation. The otolaryngologist places a 2.5 mm rigid bronchoscope with considerable resistance and ventilation is achieved through the side port. The surgeon preps and injects local anesthetic to perform the tracheotomy.

Would you administer anesthesia at this point?

Low dose sevoflurane is started. The infant is still moving and requires restraint. One anesthesiologist restrains the shoulders of the infant while the second anesthesiologist holds the rigid bronchoscope in place with one hand and restrains the head with her other hand. The anesthesiology resident assists ventilation with the circuit attached to the side port of the bronchoscope. The tracheotomy is performed without incident, a 3.5 shiley neonatal tracheostomy tube is placed and adequate oxygenation and ventilation is maintained.

The anesthetic depth is increased to stop movement. With the surgical airway secured, a femoral central venous line is placed.

The child is returned to the PICU with an arterial line, a venous line, and an airway!

### **PROBLEM BASED LEARNING DISCUSSION**

#### **Anesthesia consult to intubate in the intensive care unit**

An anesthesia consult to evaluate for intubation includes assessment of the indications to intubate which may include airway protection, maintenance of airway patency, need for positive pressure ventilation or positive end expiratory pressure, pulmonary toilet and maintenance of adequate oxygenation. If patient is oxygenating adequately and the need for intubation is not immediate, then one should complete a history and physical, assess most recent blood gases and discuss the case with the critical care team.

#### **Subglottic stenosis: etiology, diagnosis, and treatment**

Evaluation of stridor and the implications of inspiratory versus expiratory stridor. Differential diagnoses including laryngotracheobronchitis vs neurogenic vs subglottic stenosis including laryngeal web. Discussion of supportive treatment with racemic epinephrine, albuterol, steroids, and heliox including doses and side effect profiles. Present the advantages of avoiding intubation in an infant with suspected subglottic stenosis. Discuss the most common etiologies of subglottic stenosis.

#### **Cuffed vs Uncuffed Endotracheal Tubes**

Discussion of cuffed vs uncuffed ETT in a neonate or child and how to estimate ETT size and depth. Importance of monitoring ETT cuff pressure and maintaining an air leak to estimate the fit of the ETT in the trachea. Review the anatomic differences of the pediatric airway.

#### **Preoperative preparation of a potentially difficult airway**

Discussion of preoperative preparation for intubation in this scenario. When at all possible it is best done in the operating room with an otolaryngologist in continuous attendance until the airway is established. Rigid bronchoscope and tracheotomy tray should be opened and checked by the otolaryngologist. Multiple ETT sizes down to a 2.0 in the room with stylets should be readily available. Jet ventilation should be set up and checked. Discuss alternatives for intubation

and the plan for induction and maintenance including awake intubation and awake tracheotomy. Call for anesthesia back-up early.

### **Access options for administration of drugs and fluid**

Consideration of possible access sites in the “difficult IV” infant or child. Appropriate central line size and insertion site to be discussed as well as when an intraosseous line is indicated. Discuss technique for intraosseous placement. Review which resuscitation and anesthetic drugs can be given via various routes including intravenous (scalp/peripheral/central), intraosseous, intraarterial, and endotracheal. Discuss how to adjust dose for different routes.

### **Pro and con discussion of the use of muscle relaxation in this scenario**

### **Presentation of follow-up on this infant including pictures of her subglottic narrowing**

#### **REFERENCES**

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#### **LEARNING SUMMARY**

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