1. Overview
    - Advanced airway management is the subset of airway management that involves high skill and invasiveness. It comprises various medical procedures performed to create an open airway (a path between a patient's lungs and the outside world).
    - Advanced airway management relies on the use of medical equipment and special training. Invasive airway management can be performed "blind" or with visualization of the glottis e.g. using a laryngoscope.
2. Goal of the Procedure
    - Clearing or preventing obstructions of airways, often referred to as choking, cause by the tongue, the airways them self, foreign bodies or materials from the body itself, such as blood or aspiration.
    - Protecting a patient's airway from aspiration
3. Reference(s)
    - Hagberg, C. A., & Benumof, J., 1942. (2013;2012;). Benumof and hagberg's airway management (3rd), Philadelphia, PA: Elsevier/Saunders.
4. **Required Reading / Review**
    - O'Connor MF, Glick DB. Airway Management. In: Hall JB, Schmidt GA, Kress JP. eds. Principles of Critical Care, 4e New York, NY: McGraw-Hill; 2014.
    - Orotracheal Intubation Video, Christopher Kabrhel, M.D., Todd W. Thomsen, M.D., Gary S. Setnik, M.D., and Ron M. Walls, M.D. N Engl J Med 2007; 356:e15April 26, 2007DOI: 10.1056/NEJMvcm063574

To access the Clinical Key webpages listed below use the Direct Link Generator and use the second box on the page (below the OR) to put in the following URLs (one at a time) then click "show URL" to generate a link to the video and information (if the page does not display click on the generated link again)

https://www.clinicalkey.com/#!/content/medical_procedure/19-s2.0-mp_AN-003
https://www.clinicalkey.com/#!/content/medical_procedure/19-s2.0-mp_EM-003
https://www.clinicalkey.com/#!/content/medical_procedure/19-s2.0-mp_EM-009
https://www.clinicalkey.com/#!/content/medical_procedure/19-s2.0-mp_AN-004
https://www.clinicalkey.com/#!/search/retrograde%2520intubation/%7B%22facetquery%22:%5B%22+contenttype:VD%22%5D%7D

5. Required Procedure Competencies
    - **Endotracheal Intubation**
        - Performs a rapid assessment of thorax, oral cavity and airway.
        - If patient is already being ventilated, assesses adequacy of effort.
        - Describes need for intubation to patient, as appropriate and as time allows.
        - Directs staff to call for respiratory therapy, ventilator and ICU bed.
        - Verifies there is intravenous access. Assures that needed equipment is present and working prior to attempting intubation and identifies that 3 out of 3 needed items are missing or inoperable*
        - Positions patient properly.
        - Orders appropriate medications and doses to anesthetize patient.
    - **Fiberoptic Intubation**
        - Explain the procedure to the patient and obtain consent. OBTAIN CONSENT
        - Be sure the patient has an IV catheter connected via tubing to IV fluid that runs freely.
        - Apply standard monitors (blood pressure, ECG, pulse oximeter).
        - Administer an antisialagogue, such as glycopyrrolate 0.003 mg/kg IV unless contraindicated.
        - Position the patient with the head up at a 30- to 45-degree angle (prevents tongue and pharynx from collapsing posteriorly and obstructing view) and administer oxygen via nasal cannula.
        - Begin sedation, titrating midazolam 0.01 to 0.03 mg/kg and fentanyl 0.04 to 2.0 mcg/kg IV in small doses to avoid apnea. Other sedative and narcotic agents may be used.

- There are many techniques for performing awake blocks, and one method is described here. To avoid systemic effects of local anesthetic toxicity, do not exceed 7 mg/kg of lidocaine in adult patients.
- Combine 9.5 mL of viscous 2% lidocaine with 0.5 mL of 10 mg/mL phenylephrine
- Apply mixture in 3-mL aliquots in one nostril to lubricate the inside of the nose, vasoconstrict vessels in the mucosa, and block relevant trigeminal nerve branches. Wait 3 to 5 minutes and repeat. Apply 1 mL of 5% lidocaine paste to both sides of tongue depressor and have patient suck on this "lidocaine lollipop," gradually advancing the tongue depressor posteriorly over tongue and hard palate as tolerated.
- Use the remaining viscous lidocaine-phenylephrine mixture to lubricate the distal tip of a nasal trumpet. Attach a 7.0 ETT connector with a corrugated, flexible endotracheal adaptor into the proximal end of the trumpet.
- Gently place the nasal trumpet into the nostril that was blocked, being careful to avoid trauma.
- Attach the patient to the anesthetic circuit via the modified nasal trumpet with fresh gas flows of 10 L/min to improve oxygenation, monitor ventilation, and prevent obstruction. By closing the patient's mouth and contralateral nostril, it is possible to deliver positive pressure ventilation; however, the goal should be to maintain spontaneous ventilation at all times.
- When patient is able to tolerate application of the lidocaine lollipop to the back of the tongue, use it to expose the palatine tonsil.
- Using Cetacaine spray or an atomizer attached to 2% lidocaine in a 5-mL syringe, spray local anesthetic (2.5 mL of 2% lidocaine or three 1-second sprays) at each tonsil upon inspiration to block the glossopharyngeal nerve.
- Place two cotton pledgets soaked in 2% lidocaine in right-angle forceps, ensuring that the pledgets extend beyond metal tip, and wind string around forceps so that pledgets cannot be dislodged. Apply the pledgetsto the laryngeal mucosa overlying the superior laryngeal nerve by angling the forceps towards the piriform fossae. Feel for the pledgets externally by palpating the inferolateral aspect of the mandible. Hold pledgets over mucosa for 90 to 120 seconds and then repeat on contralateral side.
- Place a size 10 Williams intubating oral airway in mouth.
- Remove the ETT connector and place it within easy reach.
- Apply lubricant, such as a small drop of silicon gel, over the fiberoptic scope, spreading it up and down the length of the scope, taking care to avoid coating the lens.
- Apply antifog drop to the lens of the scope.
- Thread the ETT over the fiberoptic scope and loosely tape the two together with the bevel of the endotracheal tube facing posteriorly during the intubation.
- Insert the ETT (and fiberoptic scope) into the oral airway and advance to the posterior pharynx.
- Obtain a view of the glottic opening, pinch off the suction source, and squirt 2 mL of 2% lidocaine through the injection port of the fiberoptic scope, through the vocal cords and into the trachea to anesthetize the recurrent laryngeal nerve. Injection of local anesthetic into the trachea directly with a needle risks trauma to the trachea, and should be done only with caution.
- Advance the fiberoptic scope through the vocal cords.
- Confirm that the fiberoptic scope is in the trachea and not the esophagus by noting the presence of tracheal rings.
- Slide the endotracheal tube into the trachea and off of the fiberoptic scope.
- If ETT will not pass, the beveled tip is likely inhibited by the right arytenoid cartilage. Withdraw the ETT several cm and rotate it 90 degrees counterclockwise. Do not force the tube against resistance.
- Should repeated attempts fail, because of difficulty passing the endotracheal tube through the vocal cords despite proper visualization, consider changing to a Parker endotracheal tube, which has a tapered bevel located posteriorly.
- Confirm the correct depth of endotracheal tube by measuring distance from the carina to tip of the ETT, and reattach connector.
- <u>POST-PROCEDURE</u>
- Secure the endotracheal tube with adhesive tape to prevent accidental extubation.

    - Confirm unchanged results of neurological exam of patient if appropriate.
    - Begin delivery of general anesthetic if required by either intravenous or inhaled route.
- Cricothyrotomy
    - Position the patient supine.
    - Open and arrange the Melker Emergency Cricothyrotomy Catheter Set. STERILE TECHNIQUE
    - If you are right-handed, stand on the patient's left side.
    - Use the nondominant hand to locate the cricothyroid membrane.
    - With the dominant hand, introduce the needle attached to the syringe through the cricothyroid membrane. Point the needle caudally at a 45-degree angle relative to the skin surface.
    - Take care not to advance the needle too far or you will perforate the posterior trachea.
    - To aid in recognizing when the trachea has been pierced, place a small amount of saline in the syringe before the procedure.
    - As you advance the needle, apply negative pressure to the syringe.
    - When the needle pierces the membrane and enters the trachea, you will note air being aspirated into the syringe, creating bubbles
    - Once the needle is in the trachea, pull back the syringe and needle while advancing the flexible TFE catheter through the distal trachea to its hub.
    - If the needle does not have an overlying catheter, leave the needle in place and remove just the syringe.
    - Thread the guidewire through the needle or the catheter. Keep the guidewire in place in the trachea, and remove the needle or catheter.
    - Using a scalpel with a disposable No. 11 blade, make a small incision in the skin at the point where the guidewire enters to facilitate passage of the dilator and airway catheter.
    - Fit the gray-tipped dilator into the airway catheter and thread it over the wire as one unit.
    - Once through the skin and into the trachea, advance the airway catheter to its hub flush against the neck and remove the wire and dilator.
    - Use the tracheostomy tape from the Melker kit to secure the airway catheter.
    - Confirm proper placement of the tracheostomy tube.
    - (Proper placement is confirmed in the same manner as with endotracheal tube placement: assessment of end-tidal CO2partial pressure, bilateral chest movement, and breath sounds.)
    - After confirming proper placement, suture the tracheostomy tube into place.
    - Obtain a post-procedure chest radiograph.

- **Retrograde Intubation**
    - Perform initial percutaneous puncture at the cricothyroid membrane into the trachea with the introducer needle/catheter sheath. (Like percutaneous cricothyrotomy)
    - The needle is removed and the J-tip of the wire is passed through the catheter sheath into the trachea and to the mouth or nares.
    - The wire is recovered from the mouth or nares with fingers or forceps.
    - The wire is advanced until the black positioning mark is visible at the skin access site. The catheter sheath is removed.
    - The wire is clamped at the insertion site to stabilize its entry into the cricothyroid area.
    - The guiding catheter sheath is advanced anterograde over the wire by way of the mouth or nares until it tents the skin at the cricothyroid access site.
    - The endotracheal tube is passed over the wire/guiding catheter sheath into position below the vocal cords to the skin puncture site.
    - The needle holder is unclamped.
    - The wire/guiding catheter sheath is removed by way of the mouth, and the endotracheal tube is advanced into final position.