Tracheoplasty

**Background:**
Tracheoplasty involves the reinforcement of the posterior wall of the trachea to lessen the extent of dynamic airway collapse from such conditions as tracheomalacia or tracheobronchomalacia.

**Night before:**
1. Full w/u of patient including spirometry/baseline respiratory function, cardiac hx, etc.

**OR set-up:**
1. Standard set-up.
2. Arterial line transducer present and zeroed.
3. At least 2 CHARGED infusion pumps for epidural infusion, propofol infusion, vasopressors/dilators (if needed).
4. Additional monitors (eg CVP, PA, BIS) determined on individual patient basis.

**Pre-op** (if 7:30 case, try to see patient as early as possible as multiple lines/epidural need to be placed to ensure on-time start):
1. Determine respiratory status in AM, change in history, physical exam.
2. Good access - at least 1 large bore IV (antecubital OK though nondependent arm will be flexed and may decrease flow). One IV should be connected to blood tubing (in case products are needed though unlikely); if additional IV, attach to a leash to connect to an additional line (eg micro drip for infusions). Additional lines (eg PA catheter, multilumen CVL) per patient's history, but usually not needed if access adequate.
3. Arterial line - DEPENDENT arm if possible (almost always left arm, helps to ensure proper flow to extremity).
4. Thoracic epidural - ESSENTIAL this works. Must minimize narcotic given intraop to ensure good respiratory effort (minimize risk for atelectasis/poor respiratory effect secondary to pain) + decrease PONV risk as it is essential that patient does not buck/cough during extubation due to tracheoplasty. The goal is to place an epidural at T4-5 or T5-6, though you may go as low as T8 (scapular tip correlated w/ T5 spinous process) so the surgical field will be adequately covered (placement may be difficult since high thoracic). Bolus epidural with 2% xylocaine or equivalent in 5cc increments after negative aspiration and test dose to ensure bilateral sensory loss. Do not start APS solution until stable surgical conditions present (see below under "Intraop") with the solution running well before the end of the case.
5. Ask surgeon about whether he would like a single-lumen ETT to start with or if should start with DLT (specially made by surgeon, see below under "Induction").
6. Send any additional labs, T&S/T&C as needed (easy to draw off of arterial line).

**Intraop:**
**Preinduction**
1. ASA monitors, arterial line. Have all wires coming from patient's LEFT so that when pt placed in left lateral decub position, no cords pass over patient. Make sure to place EKG leads away from
surgical field (may need to change once pt placed in left lateral decub position to reduce risk of pressure injury).

2. Pre-O2!

**Induction:**
1. Induction per patient's history (eg cardiac hx, reflux, difficult airway, etc).
2. Single lumen ETT vs shaved DLT
   a. Single lumen for flexible bronchoscopy if indicated by surgeon. If single lumen placed first, exchange shaved DLT for single lumen ETT over Cook catheter once bronchoscopy complete.
   b. Shaved DLT - surgeon will shave off tracheal lumen so only bronchial lumen present (improves surgical operating conditions since working on trachea!). A 37F or larger DLT will be used so the FOB may be accommodated. Bronchial lumen is long and narrow, minimizing stress on graft and taking up minimal space in the trachea. Have the fiberoptic bronchoscope and suction catheters ready. As usual, important to verify positioning of bronchial lumen to ensure left upper lobe take-off visualized (typically 3.5-5 cm distal to carina, very common cause of hypoxia if LUL take-off not ventilated). However, tracheal lumen no longer present so will be unable to confirm placement by visualizing blue cuff just below level of carina (as usual w/ DLT).
3. Secure tube w/ tape.

**Post-induction:**
1. Ensure ventilator is turned on w/ 100% O2 (remember, you want to maximize blood flow and oxygenation to dependent lung). Even w/ one-lung ventilation, maintain TV and RR to goal of normal ventilation/normocarbia.
2. Ensure maintenance agent is running (either volatile agent or intravenous, depending on patient's history eg. malignant hyperthermia risk).
3. Give long-acting NDM relaxant (eg pancuronium since lengthy case) so that patient does not cough during positioning.
4. Place patient in LEFT lateral decub position (right lateral decub position VERY unusual - mediastinal structures such as the aorta would be present upon surgical exposure using left thoractomy and should be avoided if possible). Make sure to secure tube - a Christmas tree is very useful since it will take the bulk of the weight of the circuit and ensure the tube does not accidentally dislodge. Axillary roll needs to be placed to ensure proper flow to dependent extremity (arterial line in this extremity also serves as confirmation of perfusion). Once done, use FOB to ensure bronchial lumen still in appropriate position (head flexion after positioning may cause migration of bronchial lumen past LUL take-off resulting in hypoxia).
5. Non-dependent arm will be placed on arm board w/ appropriate padding and appropriately flexed (may interfere w/ antecubital IV if present). Dependent arm fully extended w/ appropriate padding.
7. Administer antibiotics per surgeon's request.
8. Administer dexamethasone early to ensure antiemesis effects present once surgery done (effect begins ~6 hrs after administration w/ duration of effect up to 24 hours).
9. Patient may become hypotensive since anesthetized and nonstimulated - observe vital signs frequently and support as needed.

**Intraop:**
1. Minimize fluids to minimize airway edema at end of case.
2. Send ABGs or give products as needed (depends on health of patient + intraop course).
2. Bolus 10-15cc of APS solution and then run at a rate of ~10 cc/hr once patient's vital signs have been stable for approximately 20 minutes - want to observe drop in BP and HR (however, if it does not secondary to surgical stresses/apneic episodes/other causes, don't worry since you tested to make sure the epidural was working before starting the case!). Do not start if patient hypotensive (for obvious reasons).
3. Exposure through RIGHT thoracotomy (as described above under "Post-induction").
4. Surgeon will ask for apnea once he plans on pursuing tracheal reconstruction. The surgeon will sew 6 to 8 rows of sutures (hundreds of stitches) in order to plicate and support the posterior wall. The bronchial cuff will need to be deflated and the bronchial lumen to be extracted and advanced as the tracheoplasty is under-way (the surgeon will tell you how far to extract or advance the tube as he will be directly visualizing the tube). This needs to be since the surgeon does not want to accidentally suture the graft to your ETT or puncture the cuff! Only reinflate the cuff and restart PPV once the tube is in the correct position w/ the surgeon's OK (he may ask you to not inflate the cuff and check to see if PPV is adequate to minimize unnecessary stress on the graft from the cuff). Give recruitment breaths if needed. If the patient's SpO2 decreases to 94% (or some other predetermined value), inform the surgeon so that he may pause and give time for the SpO2 to increase.

End of surgery:
1. The surgeon will need to bronchoscope the patient prior to extubation in order to confirm the adequacy of repair and to remove blood and secretions from the airway. Keep the patient deep enough to tolerate this, often by starting a propofol drip. The long tube may be change to a standard ETT at this time. You may use a Cook exchange catheter to facilitate this.

Extubation:
1. The patient should be in sitting position prior to extubation. The mouth may be suctioned but extreme care should be taken to avoid trauma to the repaired trachea. Blind intubation can also traumatize the airway, so extubate only with the patient showing good respiratory mechanics, adequate muscle strength, and following commands.
2. If unable to extubate, keep patient intubated to ICU for extubation at later time.

Post-op:
1. ICU bed a must!