CASE STUDY
Chapter 9: Airway Evaluations and Management

You are preparing to anesthetize a 50-year-old man for abdominal hernia repair with mesh. He is 68 inches tall and weighs 260 pounds. He has a full beard and mustache. He has no other major comorbidities. He underwent general anesthesia 20 years ago for arthroscopy of his knee and is not aware of any problems with the anesthetic. You are planning general endotracheal anesthesia.

What factors in this patient worry or reassure you regarding his airway management?
The patient is obese (BMI=39.5). In itself, this is likely a risk factor for both difficult mask ventilation and difficult laryngoscopy. He also has a full beard, which can interfere with mask fit and make mask ventilation difficult. Conversely, he appears to have had an uncomplicated general anesthetic in the past. While reassuring, there are some caveats: his lack of awareness of problems does not mean that some did not occur but were not reported to the patient or recalled, and his physique may have been quite different 20 years ago.

How will you further assess his airway?
You will perform basic airway examinations on the patient. No one test is definitive, but most anesthesiologists use the Mallampati test, the thyromental distance, and a subjective assessment of neck mobility. Some use other tests as well, such as neck circumference (cutoff > 17 inches or 43 cm), ability to protrude the lower incisors anterior to the upper incisors, mouth opening, or sternomental distance. Each correlates somewhat with difficult intubation, but ultimately the judgment is likely more subjective and reflects the clinical gestalt of the experienced anesthesiologist.

You decide to proceed with induction of anesthesia. After administering propofol you attempt mask ventilation. You find it difficult to obtain a good mask fit and mask ventilation is difficult. How will you proceed?
You anticipated this problem preoperatively, so you have backup plans already in place. You can try an oral or nasal airway, which may reduce the pressure required to ventilate the patient by helping hold the upper airway patent. In some cases using both may be helpful. You can also perform two-person ventilation, with one person holding the mask fit with both hands and the other ventilating by squeezing the reservoir bag. Finally, you can consider placement of an LMA to assist ventilation, or proceed directly with intubation.
You are now successfully ventilating the patient. You administer rocuronium to facilitate intubation. After ventilating the patient for 3 minutes, you perform direct laryngoscopy with a Macintosh 3 blade. You can only visualize the tip of the epiglottis. How will you proceed?

As before, you have anticipated the possibility of this situation and have alternative plans in place for intubation, but you will not simply try again with the same technique: Plan B is not more of Plan A! A common initial step is to apply cricoid pressure either yourself, watching the laryngoscopic view as you do, or with a skilled assistant. In any difficult situation, consider calling for help early; it is better to ask for help and not need it than it is to be in trouble and unable to get it. Next, change the head position, laryngoscope blade, or operator. In obese patients, ramping the head of the bed, by putting several blankets under the shoulders, and more under the head (or using a specialized pillow such as the Troop elevation device), can markedly improve the view. A straight blade (Miller) can sometimes lift the epiglottis more efficiently than the curved (Macintosh) blade. Always ensure you have a good mask airway between efforts. No one ever died from lack of intubation per se, but lack of ventilation can kill! Use of the LMA, even if you have not done so yet, can be lifesaving if mask ventilation becomes impossible. This technique is now a standard part of the ASA Difficult Airway algorithm (see Appendix A).

Your initial efforts are still yielding only a view of the epiglottis. You decide to use an alternative airway device to assist you. What are some of your options?

In cases such as this, you can often successfully intubate the patient even without a view of the vocal cords. Some experienced anesthesiologists will attempt a blind pass of the stylet-angled endotracheal tube under the epiglottis. More frequently an alternative device, such as the Bougie, is passed under the epiglottis first. One can often feel a clicking sensation as the tip brushes along the cartilage rings of the trachea. Then an endotracheal tube can be passed over the Bougie into the trachea. Other options are to improve the view with different laryngoscopes. A video enhanced device, such as the GlideScope, Bullard laryngoscope, or C-Mac can display a better view than a conventional laryngoscope because of the integration of a camera or fiberoptic port on the distal aspect of the laryngoscope blade. Still another option is to use a flexible fiberoptic bronchoscope with an endotracheal tube threaded over it to locate the glottis. The endotracheal tube is then threaded off the bronchoscope into the trachea. Still other options include use of the LMA for the case, intubation through the LMA with a fiberoptic technique or with the intubating LMA (which is specially adapted for passage of an endotracheal tube without the need for a fiberoptic scope), or even to awaken the patient and cancel the case. In this case, you have administered a non-depolarizing muscle relaxant, so you will need to continue to manage the airway until this drug can
be reversed, many minutes from now. Most anesthesiologists have a favorite approach to situations such as these and it is generally prudent to use a technique that you are comfortable with, rather than attempt something unfamiliar in an emergency situation. For this reason, trainees should gain experience in elective situations with as many different devices and techniques as possible.

A 70 kg otherwise healthy male patient is undergoing bilateral inguinal herniorrhaphy under local anesthesia administered by the surgeon and intravenous sedation you are giving. The surgeon is planning to infiltrate the skin with lidocaine prior to skin incision.

The patient reports a history of an “allergic reaction” to Novocain (procaine) which she received during a dental procedure. Is it safe to administer the planned local anesthetics? Most dental reactions are not true allergies, but either unpleasant sensations from the intended local anesthetic effect (numb tongue and lips that feel swollen), or tachycardia from absorbed epinephrine. Even if the patient were truly allergic to procaine, it is exceedingly unlikely that he would also be allergic to lidocaine or bupivacaine, which are amide type local anesthetics, whereas procaine is an ester type drug.

The surgeon is planning to use 2% lidocaine with epinephrine for initial infiltration, followed by bupivacaine, 0.5% for longer lasting analgesia. How can she enhance the onset of the block? Lidocaine with epinephrine is prepared with very low pH in order to stabilize the local anesthetic and the epinephrine, which is unstable at neutral or basic pH. At pH 4-5, that of commercial epinephrine containing local anesthetic solutions, only a tiny fraction will be in the uncharged, base form, which can permeate nerve cell membranes. The addition of bicarbonate, 1 mL per 10 mL of local anesthetic solution, will raise the pH and the unionized fraction, speeding the onset. This treatment also significantly reduces the pain of injection, an additional benefit.

After infiltration with lidocaine, the surgeon is prepared to infiltrate further with bupivacaine and perform some deep nerve blocks to enhance analgesia. She asks you how much of a 0.5% solution she can safely use. How will you respond? The limit for a single subcutaneous infiltration is approximately 2.5 mg/kg. A 0.5% solution of bupivacaine contains 5 mg/mL, so the surgeon can use 175 mg, or 35 mL. This is an estimate based on average rates of absorption, and in practice actual toxicity often does not occur even at doses higher than this. Conversely, this limit assumes no drug is injected intravascularly.
The surgeon begins infiltration with bupivacaine. After about 15 mL have been injected, the patient complains of lightheadedness and then his eyes roll back and he loses consciousness. The patient develops tonic-clonic movements of his extremities. How will you respond?

Seizures associated with local anesthetic toxicity are treated symptomatically. Tell the surgeon to immediately stop injecting to limit further toxicity. You should administer supplemental oxygen and maintain the airway. If the patient is not breathing, you should administer positive pressure ventilation by mask. Intubation is not always necessary, as seizures associated with local anesthetic are often short lived. A small dose of midazolam (a benzodiazepine) or thiopental will help terminate the seizure.

Despite your initial efforts, the patient remains unresponsive. The electrocardiogram shows ventricular tachycardia. You cannot palpate a pulse. How will you proceed?

Your patient has developed a much more severe form of toxicity, cardiovascular compromise. This syndrome is associated with potent lipophilic anesthetics such as bupivacaine (had the surgeon only been using lidocaine, this complication would have been less likely). Immediate treatment is supportive: administer CPR and begin ACLS treatment for ventricular fibrillation (epinephrine or vasopressin, defibrillation). Unfortunately, bupivacaine-associated cardiovascular toxicity is often very difficult to reverse. Supportive treatment may require cardiopulmonary bypass until the local anesthetic can be cleared. A still experimental but very promising treatment is infusion of a lipid emulsion solution like that used in total parenteral nutrition (Intralipid). Current recommendation is to use 1.5-2 mL/kg of a 20% solution given as IV bolus, followed by an infusion if successful. In animals and a few human case reports, this treatment has proven dramatically successful. Importantly, even though propofol is packaged in a lipid emulsion, it should not be substituted because the vasodilation and cardiac depression associated with a large dose of propofol may counteract the effects of the lipid.