How to Be a "Star" Student, Career Options, and the Match

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For maximum impact, it is recommended that Case Study 1.1 be reviewed before reading this chapter.

Introduction

If your favorite place in the *world* is the operating room, be a surgeon. If your favorite place in the *hospital* is the operating room, be an anesthesiologist. For many, the practice of anesthesiology is the perfect blend of science, medical management, procedural skills, variety, and fun. Where else can you care for critically ill patients, listen to music, socialize with surgeons, and wear your pajamas all at the same time?

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This chapter will outline:

- suggested preparation and goal setting for your medical school anesthesia rotation
- career options within anesthesiology
- the future of anesthesiology as a specialty
- the Match
- a run-through of a typical case
- guidance for approaching preoperative evaluation

How to Be a "Star" Student

Your road to being an anesthesiologist starts as early as medical school rotations. Even if you don't have an interest in any other specialty, much of what you learn in your core clerkships will be applicable and important foundational knowledge for anesthesiology. Although anesthesia rotations may be shorter (e.g. two weeks) or elective only, that makes it all the more important to structure your rotation for high yield, both in learning and exposure to the specialty [6]. Many programs are moving away from the "show up and we'll stick you somewhere" method of teaching; start by identifying the educational objectives set by the clerkship director. Here are a few tips for standing out and making the most of your rotation:

1. **Come with flexibility and a positive attitude.**
   Anesthesia is a team game; the kind of cases and how involved you can be might vary day to day, so come in with an open mind and eagerness to learn. Adaptability is an essential skill for an anesthesiologist, and it will serve you well to hone this early on [7]. *It is not expected that you are a pro at placing IVs or know all there is to know about volatile anesthetics, but enthusiasm will go a long way.*
2. **Read about fundamental pharmacology/physiology principles (see suggested reading topics [**Table 1.1**]).**
   In most cases, there will be time for intraoperative teaching so it is helpful to have some foundational knowledge about

Table 1.1 Suggested reading topics

Review airway anatomy and various intubating techniques/tools (e.g. ETT, LMA, bougie, fiberoptic, videoscope) (Chap. 9)
Review principles of preoperative assessment (Chap. 8)
Review basic respiratory and cardiac physiology (Chap. 18)
Review autonomic nervous system pharmacology (Chap. 3)
Review cholinergic and anticholinergic pharmacology (Chaps. 4 and 7)
Review opiate pharmacology (Chap. 4)
Review local anesthetic pharmacology (Chap. 6)
List commonly used medications in each of the following classes: (Chaps. 4, 5, 6, and 7)
Sedative/Hypnotics
Volatile agents
Antiemetics
Neuromuscular blockade and reversal
Local anesthetics
Opioids
Adrenergics (agonist and antagonist)
Non-opioid analgesics

Adapted from original content, courtesy of J. Ehrenfeld

some topics to build on. Focus on quality of material, not quantity – this will be a unique opportunity to see physiology in action (e.g. phenylephrine raising the blood pressure by increasing systemic vascular resistance) so it can help solidify the knowledge of those topics that you learned from your basic science courses and core rotations.

3. **Identify specific learning goals (see some examples [**Table 1.2**]).**

   Take ownership of your rotation. What do YOU want to get out of it? What topics interest you? What questions have come up during your reading? Come each day with at least 1–2 topics you would like to discuss. At the beginning of the rotation, list specific and achievable goals for yourself (think SMART goals) and discuss them with your attending/resident/CRNA.

4. **Know and advocate for your patients.**

   As able, take time to read about the patients that you will be caring for the night before their surgery. Familiarize yourself

Table 1.2 Examples of specific learning goals

Practice mask ventilation on >50% of your patients
Attempt laryngoscopy and endotracheal intubation in 3–5 of your patients
Place/attempt 3–5 PIVs in your patients
Observe at least 1 epidural, 1 spinal, and 1 peripheral block[a]
Spend 1 day in pain clinic or with a pain service[a]
Spend 1 day on an OB anesthesia team[a]

Adapted from original content, courtesy of J. Ehrenfeld
[a]These may be opportunities only offered on sub-specialty or advanced rotations (usually during 4th year)

with their medical conditions, allergies, medications, etc. There may be times when that information is crucial to patient safety, such as avoiding medication errors. Many patients feel very nervous before surgery, so even seemingly insignificant actions (e.g. holding their hand as they go off to sleep) can have a big impact.

5. **Take all the learning opportunities, big and small.**

   You may get the opportunity to practice procedures like intubations, arterial lines, or IVs during your rotation; when you do, take a deep breath and just do your best. Those skills take time to develop, so even an unsuccessful attempt is a useful experience. There will be other opportunities to help, like attaching the patient's monitors, drawing up medications, or spiking IV fluid bags. Willingness to help with these smaller tasks will go a long way (see tip #1), and these are very relevant skills for an anesthesia residency and career.

6. **Develop healthy habits for stress management**

   At this stage in your training, it is likely that you already have been under high levels of stress; the academic rigor, clinical expectations, and emotional toll of medical education can manifest itself in physical, mental, relational, and academic decline. Excessive stress is associated with poorer academic outcomes and increased burnout [19].

   Moreover, studies show an average of 1 in 4 medical students will experience depression, and 1 in 10 medical students will experience suicidal ideation [17]. *During residency, rates of depression are between 20.9–43.2%, and show a 0.5%*

increase per calendar year [12, 18]. *Anesthesiologists in particular are found to have the highest risk of death by suicide of any medical specialty* [3, 16]. *Though these data are sobering, it underscores the importance of building healthy coping habits from the very beginning of training. Integrating practices of adequate sleep* [4], *physical exercise, mental health care including counseling or medication, meditation or yoga* [11], *maintaining hobbies outside of medicine, and meaningful relationships with family and friends will pay dividends later. Although it may seem nearly impossible, developing these habits early in your medical training will serve as the foundation for career longevity and success.*

If you or someone you know is struggling with depression, substance abuse, or thoughts of suicide, ***you are not alone.*** *We've provided a list of resources at the end of this chapter that can help, and in an emergency, you can always call the National Suicide Prevention Lifeline by dialing 988 or visiting https://988lifeline.org.*

7. ***Set a personal standard of professionalism***

It is easy to anchor on academic performance as an objective measure of competence; however, studies show that professionalism violations are one of the top reasons for lack of success in medical school or residency. It is especially difficult to remediate professionalism, unlike most academic or clinical skills [2, 15]. *Qualities like accountability, altruism, ethical behavior and personal well-being are critically important in an anesthesiologist* [20]. *Clearly, it is not just a matter of how much you know, but also how you conduct yourself. Furthermore, unprofessional behavior in medical school has been linked to disciplinary actions by state medical boards later in one's career* [13]. *Start now by developing a high standard for yourself in regards to professional conduct – in how you interact with patients, on medical teams, and even on social media.*

8. **Find a mentor (or a few)**

Arguably the single most important step in setting yourself up for success in anesthesiology is choosing a good mentor. Although a physician who is an anesthesiologist would be able

to give you the most specific information and advice, it is also useful to have mentors in other disciplines for support and encouragement in surviving medical school, taking boards, balancing your own health and family life, choosing a specialty and residency, and more [8, 9]. *Lean on those who have walked the path ahead of you; don't be afraid to ask for help and specifically ask, "Will you be my mentor?" Most faculty members choose to remain in academic medicine because they are passionate about education and mentorship. A successful mentor-mentee relationship requires shared expectations and realistic time commitment.*

Career Options

As an anesthesiologist, you will have a variety of career options to choose from. Some physicians choose to stay in academic medicine – focusing on research, teaching, or advancing clinical practice. Others choose to go into private practice – most often working for a private group that contracts with a hospital, or more frequently becoming direct hospital-paid employees or employees of a larger multispecialty or national group.

Within the specialty, individuals may opt to complete advanced training or fellowships after residency in a variety of accredited [1] or non-accredited sub-specialties, including but not limited to:

- critical care
- acute or chronic pain medicine
- regional anesthesia
- sleep medicine
- adult cardiothoracic anesthesia
- obstetric anesthesia
- pediatric anesthesia
- palliative care/hospice
- neuroanesthesia
- clinical informatics
- perioperative medicine
- global health

Some anesthesiologists obtain other advanced degrees, such as MBA, MPH, or JD and work in the overlap of those sectors with medicine; there are endless opportunities for policy and advocacy, hospital leadership, global health efforts and even serving in the military as an anesthesiologist. Many individuals choose to engage in research training – either during or after their residency. Currently, the American Board of Anesthesiology will allow some residents to enter into the "clinical scientist" pathway – which provides for a 6-month research experience during the final (CA-3) year of residency [5].

The location, size, and type of practice you choose will ultimately affect your practice model. In some states and regions, there is an increased reliance on physician extenders including Anesthesiologist Assistants (AAs) and Certified Registered Nurse Anesthetists (CRNAs). These members of the care team function as advanced practice providers (APPs) under the supervision of a physician as a response to the high demand for anesthesia. Nurse anesthetist/AA supervision in the "anesthesia care team model" is a safe, effective, and efficient way to provide care [10]. That being said, there are a number of variations on the theme, with physician-only practices still popular, and supervision ratios varying widely from 2:1 to 4:1, depending on the setting.

CRNAs are registered nurses who have completed masters-level training in nurse anesthesia following nursing work in a critical care environment. AAs have also completed masters-level training in anesthesia, with an undergraduate degree typically in pre-med or a similar science major. Not all states support AA practice, and there are fewer training programs for AAs than for CRNAs. However, this number increases annually and the role of AA's will likely become more prominent within the specialty in coming years.

Ultimately, the numerous and diverse possible paths available within the specialty mean that most anesthesiologists can build a happy, successful, satisfying career that centers around their interests, skills, and priorities. The future of the specialty continues to be bright.

The Future of the Medical Specialty of Anesthesiology

Along with the rest of healthcare, the specialty of anesthesiology is undergoing some dramatic changes; some common questions often asked by medical students include: Will the medical specialty of anesthesiology continue to exist, particularly given the growing use of CRNAs and AAs? What is the role of the physician-led, care team model? How will technology, including artificial intelligence and closed loop anesthesia control systems, affect the practice of anesthesia? While the way in which anesthesia is practiced today may not be the way it is practiced a decade from now, there will always be a need for well-trained, qualified anesthesiologists. The growth of the perioperative surgical home model, along with the increasing demand for physicians who can design and create systems that can efficiently deliver high-quality and cost-effective care, will drive this demand [14].

The SARS-CoV-2 (COVID19) pandemic of 2020 shone the spotlight on anesthesiologists as frontline workers in a global distaster, both as the principal airway management specialists as well as experts in caring for critically ill patients. This brought with increasing occupational hazards, but it also exemplified how the role of a physician anesthesiologist is ever-changing but never replaceable. As you contemplate entering the field of anesthesiology, keep an open mind. You very well may be the person that helps define what the field looks like for the next generation of anesthesiologists!

The Match

As a specialty, anesthesia has had its ups and downs in popularity, and is now considered a very highly sought-after field. Many seek out the challenge of solving complex physiologic problems in real time, the ability to work in the operating room environment, or the satisfaction of placing endotracheal tubes, invasive monitors, and/or advanced nerve blocks. In addition, the flexible schedule and ability to balance clinical practice with other interests (e.g. teaching, research) are other appealing features of the practice of anes-

thesiology. The Match is currently very competitive, with hundreds of applicants applying for, on average, a dozen positions at popular programs. Figure 1.1 outlines typical milestones for a medical student interested in pursuing anesthesia.

As with most specialties, applicants must use the ERAS system, whether applying for PGY1 or PGY2 positions. All programs formed as of 2008 must have an integrated internship called a "Clinical Base Year" (predominately medicine, surgery, and critical care) instead of the traditional preliminary medicine or surgery internship, and chances are that all programs will move in this direction eventually. Couples matching is supported, and there is no early match system.

Residency interview selection comes from a comprehensive evaluation of personal statement, Dean's letters, class ranking, honor society selection, grades, and letters of recommendation as well as considerations such as geography and medical school reputation. While in the past some programs adhered to strict USMLE Step 1 score cutoffs, programs are moving away from this in light of USMLE reporting Step 1 exams as pass/fail. Therefore, receiving a passing score the first time Step 1 is taken is vital in order to remain a competitive candidate in the match. With that in mind, most programs can only interview ~10 candidates per position

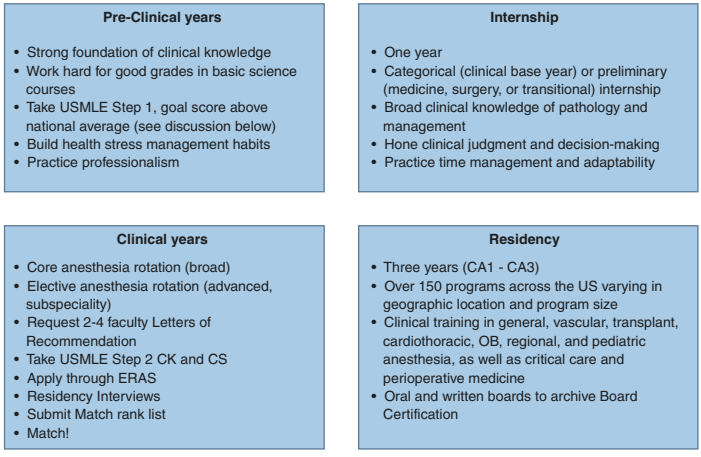

Fig. 1.1 Key milestones on the road to a career in anesthesiology

available, so a well-rounded application will stand out compared with an application with only one area of excellence. The National Resident Matching Program (NRMP) *Charting the Outcomes* data, available on their website, can give some general data on applicant demographics, including average Step 1 scores. Lean on your school's advisors as you build your application, and make it an accurate reflection of who you are, what you have done, and what you will bring to a residency program and anesthesiology as a whole.

Programs may sometimes give priority to applicants they know, whether they are students from their own hospital system or visiting students who have rotated with them. Away rotations aren't considered essential, like they are in other specialties, but may be a good idea if you are set on getting into one particular program or have less-than-impressive test scores. Having personal experience in a department can be a great way to gain an advantage over competing candidates and get to know the program much better than you can from one interview day.

A Typical General Anesthesia Case

Although the anesthesiologist needs to consider various patient and procedure factors when administering anesthesia care for a patient, there is a general workflow in the pre-op holding area, in the operating room, and in the recovery room (PACU) during a typical general anesthetic. Figure 1.2 outlines the phases of a typical general anesthetic case.

Now, let us discuss the flow of a routine general anesthetic:

Josh is a 33-year-old man with cholecystitis who needs his gallbladder removed.

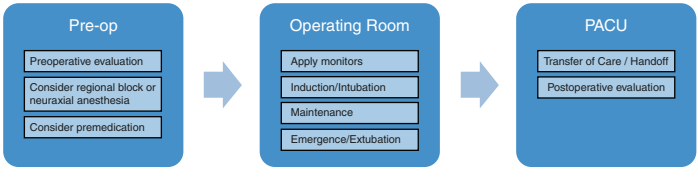

Fig. 1.2 Phases of a typical general anesthesia cases. (Adapted from original content, courtesy of J. Ehrenfeld)

Preoperative Evaluation

Josh has a history of hypothyroidism, but takes his medications and recent thyroid studies are normal. He has no drug allergies, has a good mouth opening, excellent neck extension/flexion, and good dentition. He had an appendectomy 10 years ago, and reports no problems other than postoperative nausea.

Unlike the standard internal medicine history and physical, a preoperative evaluation for anesthesia is much more focused, with specific attention being paid to the airway and to organ systems that are at a potential risk for anesthetic complications. The type of operation and the type of anesthetic will also help us focus our evaluation. Prior problems with anesthesia are noted, and physical exam should focus on the heart, lungs, and airway. See Fig. 1.3 for a sample preoperative template and guide to anesthetic plan.

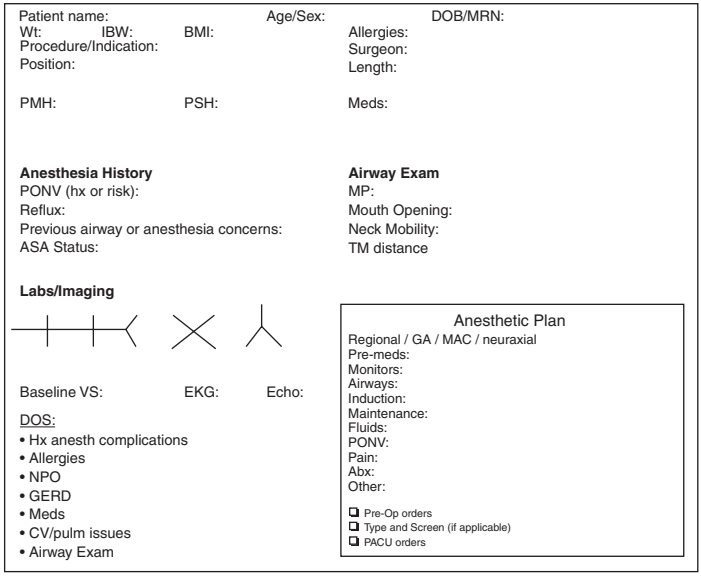

Fig. 1.3 Example of a preoperative assessment template. IBW ideal body weight, PONV post-operative nausea and vomiting, ASA American Society of Anesthesiologist classification, MP Mallampati score, TM thyromental, VS vital signs, DOS day of surgery, GA general anesthesia, MAC monitored anesthesia care, Abx antibiotics

Preoperative Medication

Josh seems relaxed, but his palms are sweaty and his resting heart rate is 90 bpm. Administering 2 mg of midazolam has calmed him right down, and he jokingly asks if he can have it for his kids as he giggles his way into the OR.

Although many patients may try to hide it, anxiety about surgery (as well as pain, prognosis, and being unconscious and naked in front of strangers) is quite common, and understandably so. We frequently sedate patients with midazolam (a benzodiazepine) and/or fentanyl (an opioid) prior to travel to the OR, with the goal of achieving anxiolysis and amnesia, while maintaining normal breathing and airway protective reflexes. Other medications that can be given in preop include oral pain medications (e.g. Tylenol or Celebrex) for multimodal analgesia, or anti-emetics like a scopolamine patch. Regional or neuraxial anesthesia may also be employed where applicable.

Monitoring

Given Josh's good health, you decide to attach him to the standard intraoperative monitors: continuous ECG (3 or 5 lead), noninvasive BP cuff, continuous pulse oximetry, and capnography.

The monitors listed above are the four standard required intraoperative monitoring for general, regional, or sedation anesthesia cases. Additional monitors may include bispectral index (BIS), temperature, invasive blood pressure (e.g. arterial line), central venous pressure monitor, pulmonary artery pressure monitor, TEE (transesophageal echocardiography), and processed EEG (electroencephalography) monitoring, all at the discretion of the provider and guided by the patient's health status and type of procedure.

Induction and Intubation

Josh has a normal-appearing airway, is otherwise healthy, and his operation requires approximately 1 h of paralysis to ensure appropriate abdominal relaxation for pneumoperitoneum (CO_2 insufflation of the abdomen). We will perform a typical induction using propofol (2 mg/kg) and rocuronium (0.6 mg/kg) and intubate him using a Macintosh 3 blade and a 7.5-mm cuffed endotracheal tube. We will confirm tube placement by visualizing chest rise, "misting of the tube," checking for end-tidal (exhaled) CO_2, and listening for bilateral breath sounds.

Following preoxygenation, general anesthesia is induced with a variety of hypnotic and paralytic medications. Propofol is the most widely used induction agent today, with rapid and predictable loss of consciousness in about 20 s, amnesia, and depression of airway reflexes. Other agents include thiopental (a barbiturate), ketamine, which is reserved for those needing a sympathetic boost (e.g. trauma patients), and etomidate, which has minimal cardiac depressant properties and is typically reserved for patients with heart failure or shock. Paralytics come in two flavors: depolarizing and nondepolarizing – with succinylcholine being the only available example of the former. Succinylcholine produces the most rapid paralysis (45 s), but can be associated with hyperkalemia, malignant hyperthermia, and myalgias. The nondepolarizers are slower and longer acting, but are the most predominantly used agents (vecuronium, rocuronium, cisatracurium, and less frequently pancuronium), with each agent having its own unique advantages and disadvantages.

Intubation is performed following preoxygenation, loss of consciousness, and onset of paralysis using a rigid laryngoscope and a plastic endotracheal tube. The actual mechanics of intubation are much better taught on actual patients, and will not be discussed here. In brief, the more intubations you do, the better you get, and the tube will make it into either the right hole (trachea), or the wrong hole (esophagus). The key to success is rapidly determining which it is, and correcting a mistake quickly. A number of alternate airway techniques are available, including awake

fiberoptic techniques, laryngeal masks, indirect visualization devices such as the Glidescope & McGrath video laryngoscopes, and blind techniques such as the Light Wand (see airway chapter for further details).

Maintenance

Now that the intubation is over, we will attach any additional monitors and start the maintenance phase of Josh's anesthesia. We will use isoflurane (1.1% exhaled concentration), fentanyl (1–2 mcg/kg every 20 min as needed, titrated to heart rate and blood pressure), and rocuronium (5–10 mg every 30 min as determined by peripheral nerve monitoring). Given his risk factors for postoperative nausea and vomiting (PONV), we will give him a dose of dexamethasone (4 mg) at the start of the case and ondansetron (4 mg) at the end.

Maintenance of general anesthesia is usually achieved with inhalation of potent volatile agents such as sevoflurane, isoflurane, or desflurane (each with their unique potential advantages and disadvantages). Many anesthetic agents have a summative effective, which promotes the concept of balanced anesthesia - giving drugs from multiple classes decreases the total dose of any one agent required, thereby reducing the chance of side effects. Therefore, in addition to volatile agents, we frequently add nitrous oxide, opioids, IV hypnotics, and paralytics to the mix. If desired, inhaled anesthetics can be avoided completely using a total IV anesthetic (TIVA) technique which is technically more difficult to perform, but can be used to great advantage in certain patients (e.g. patients with risk of malignant hyperthermia) or severe PONV.

Emergence

The case is nearing its end, and it is time to start thinking about emergence. Josh has had an uneventful procedure, is breathing on his own with excellent spontaneous minute ventilation and oxy-

genation, and is hemodynamically stable. He received neostigmine and glycopyrrolate to fully reverse his paralysis, and incremental doses of morphine are titrated to respiratory rate (the goal is the rate in the 10–20 breath per minute range) to achieve a smooth, pain-free wake-up.

There are several well-established extubation criteria: a patient must be hemodynamically stable, be oxygenating and ventilating well, be relatively normothermic, and have return of neuromuscular function. Most importantly, the patient must be able to protect his/her own airway… you've probably seen anesthesiologists asking patients to "open your eyes!" at the end of the case…no, there's no oculo-airway reflex, but we assume that once a patient is awake enough to follow simple commands, that patient is also awake enough to protect his/her airway.

Volatile agents are rapidly exhaled once inspired vapor is turned off, and most intravenous agents have a short enough half-life to ensure rapid awakening. Paralytics usually are actively reversed with cholinesterase inhibitors (increasing acetylcholine available to compete with the paralytics) in tandem with antimuscarinics to counteract unwanted side effects, or sugammadex, a cyclodextrin that selectively reverses rocuronium and vecuronium. Again, antiemetics are frequently given at this point, as are pain medications.

Post Anesthesia Care Unit (PACU) Management

Josh has done well, but upon arrival to the PACU, he begins to complain of pain and nausea despite your best intraoperative efforts. You prescribe doses of promethazine (for nausea) and hydromorphone (for pain), and he ends up meeting discharge criteria in 30 min… another successful anesthetic!

Anesthetic management does not end as soon as the tube comes out! The recovery period can be marked with challenges big and small, and as always, being properly prepared and expecting the unexpected can improve patient safety and satisfaction. Pain, nausea, and shivering are probably the most common complaints (in that order), but other frequently encountered problems include delirium, airway obstruction, bronchospasm, hyperten-

sion, hypotension, tachycardia, postsurgical bleeding, and oliguria. Furthermore, some patients cannot be extubated in the OR, and PACU care, therefore, can include many aspects of intraoperative and Intensive Care Unit (ICU) care.

Chapter Summary

Enjoy your time during your anesthesia rotation! Make sure to come to the clerkship with a good attitude, adaptability, your own goals and objectives in mind. You will likely enjoy doing procedures, but do not worry if you miss some – these skills all take practice, and even an unsuccessful attempt is useful in the learning process. Take the opportunity to also pick the brains of those that you are working with to optimize your time. If you find that anesthesia is not the specialty for you, just direct your efforts to those aspects of anesthesia that most overlap with your career choice and pique your interest: obstetric, pediatric, cardiac anesthesia, regional, pain, etc. Anesthesiologists are experts in physiology, pharmacology, clinical monitoring, and, above all, safety; they have to establish patient rapport rapidly, allay fear, and educate their diverse patients. To make the most of your time on your anesthesia rotation(s), remember to read ahead, ask plenty of questions, and have fun!

Case Study

You are preparing to provide general anesthesia for a 40-year-old woman undergoing an abdominal hysterectomy. She is otherwise healthy. She had two uncomplicated vaginal deliveries in the past, both with uncomplicated epidural labor analgesia. She had uneventful general anesthesia for a laparoscopic tubal ligation 4 years ago. Your attending is willing to let you perform as much of the anesthetic as you are able to describe in detail.

You go into the OR first thing in the morning to prepare the room for your case.

You will do safety checks on the anesthesia machine and make sure your oxygen tank is full. You will draw up all the medications and prime your IV infusions (if any) that you will need for the case. You will set out and organize your airway equipment (planned and emergency backup). You will ensure your monitors are set up and ready to go.

Upon meeting the patient in the pre-op area and reviewing the history and physical, you find no important new information. What steps will you take to prepare the patient for surgery prior to any interventions?

You will greet the patient and her family and answer any questions they may have about the procedure and planned anesthetic. You should review the remainder of the chart, paying special attention to any laboratory studies that may have returned since her pre-op clinic visit, including the hemoglobin and whether she has a sample in the blood bank. You will verify that surgical and anesthetic consent forms have been signed before giving her any preoperative medications. You will check the admission vital signs.

You have engaged the patient and checked all the paperwork and you are ready to begin preparing the patient for surgery. What are the next steps?

You will start an IV, probably a single 18 or 20 G cannula. Some anesthesiologists use a skin wheal of 1% lidocaine at the entry site before placing the IV. You will begin an infusion of IV fluid, typically lactated Ringer's solution. If the patient is anxious, you may consider anxiolysis or light sedation prior to surgery. Not all patients require this and asking the patient whether she would like it or not can help you decide. If desired, midazolam, 1–2 mg with or without fentanyl, 50–100 μg, is a reasonable choice. It is prudent to place a pulse oximeter and to consider supplemental oxygen by mask or nasal cannula, especially if you are leaving the bedside.

You have brought the patient into the OR. Describe the steps you will take prior to induction of anesthesia.

You will help the patient move over to the operating table and position the patient comfortably, making certain her gown is not tied at the neck or in back, and that all pressure points are well-padded. You will apply standard monitors (discussed in Chap. 11), including 3- or 5-lead EKG, pulse oximeter, and noninvasive blood pressure cuff, and verify that all are working properly with a baseline reading. You will then preoxygenate the patient (more precisely, "denitrogenate") by having her breathe 100% oxygen by facemask for several minutes to replace the room air in her lungs (and more specifically functional residual capacity or FRC) with oxygen. With your attending present and the rest of the surgical team (surgeon, circulating nurse, scrub nurse or technician) ready, you can induce anesthesia.

How will you induce anesthesia?

Intravenous induction is most common in adults. A short acting hypnotic, typically propofol, is given to induce unconsciousness. Next, you will ensure that you can ventilate the patient by mask by giving a few breaths and observing chest movement, exhaled carbon dioxide, and noting a reasonable tidal volume on the ventilation monitor. A neuromuscular blocking drug is then given to facilitate endotracheal intubation. Succinylcholine is rapid-acting and reliable, though some anesthesiologists prefer the nondepolarizing type (rocuronium or vecuronium), which can take slightly longer to reach peak effect but may have fewer side effects. After about a minute (succinylcholine) or 2–3 min (nondepolarizers), you will intubate the trachea. A laryngoscope is inserted, carefully avoiding trauma to the lips, tongue, and teeth. The vocal cords are visualized and a cuffed endotracheal tube, usually 7.0 or 7.5 mm internal diameter is inserted until the cuff is below the cords. The cuff is inflated, the tube is connected to the anesthesia machine circuit, and positive pressure breaths are given by hand. You will look for adequate chest rise, misting in the tube, and end-tidal CO_2. Auscultation of bilateral breath

sounds verifies appropriate depth of the tube, which is then secured with tape. The patient can then be ventilated mechanically by activating the ventilator on the anesthesia machine.

Following induction, what else will you do prior to the beginning of the surgical procedure?

You will tape the patient's eyes closed to prevent corneal injury. You will reposition the patient for surgery, if necessary, and check pressure points again. You may add additional monitors (peripheral nerve stimulator to monitor neuromuscular blockade, esophageal temperature probe, processed EEG or consciousness monitor [e.g., BIS]). Often, you will employ a convective air-warming device to help maintain normothermia. Prophylactic antibiotics are best given less than 60 min before incision, so you will start these now if you have not given already. In some operations, a nasogastric or orogastric tube may be useful (but probably not in this case). In others, you might want a second IV or arterial line, a fluid warmer, or a blood administration set. Since you do not expect large fluid shifts or blood loss, you will forego these for now. You will participate in a "safety pause," "time-out," or a more extensive "surgical safety checklist" with the other members of the OR team. You will also begin your maintenance anesthetics.

How will you maintain anesthesia?

There are numerous ways to maintain a general anesthetic, which will be discussed in future chapters. A common one is the "balanced technique" which combines a volatile anesthetic with or without nitrous oxide, an opioid, and a nondepolarizing neuromuscular blocking drug. A reasonable combination would be sevoflurane, fentanyl, and vecuronium. Sevoflurane is rapidly eliminated after discontinuation, so nitrous oxide is not necessary to reduce the amount of sevoflurane given as it might be for a more slowly eliminated drug like isoflurane (see Chap. 5).

What other adjunctive drugs might you give in addition to anesthetics?

A healthy young woman such as our patient is at reasonably high-risk of postoperative nausea and vomiting (PONV). Prophylactic antiemetics are often given, and a reasonable combination would be dexamethasone and ondansetron. You may be asked to give other drugs to facilitate the operation, for example, methylene blue to check for integrity of the urinary bladder. You will also consider longer-acting opioids (for example, morphine or hydromorphone) before the end of the procedure to provide longer-lasting analgesia in the postoperative period.

The operation has gone well and is ending. How will you conclude the anesthetic?

As the surgical stimulation lessens during closure, you will lighten the anesthetic. After the fascia is closed, you can reverse neuromuscular blockade with sugammadex or a cholinesterase inhibitor (e.g., neostigmine) and an antimuscarinic (e.g., glycopyrrolate). You can prepare for emergence by suctioning the patient's mouth, untaping the eyes, and turning off the volatile agent and increasing fresh gas flow of oxygen to help wash out residual anesthetic in the circuit. If the room is cool, you will increase the temperature; if the patient's gown is soiled, it may be changed. Once the surgical instrument and sponge counts are completed, the wound is closed, and the dressing is in place, you can wake up the patient. You will watch for return of spontaneous respiration, switching off the ventilator and allowing the patient to breathe on her own when she is ready. You will ask the patient to open her eyes and to follow a simple command (e.g. "Squeeze my fingers"). Once you are satisfied that she is awake, breathing adequately, and strong enough to protect her airway, you will extubate her by deflating the cuff and removing the endotracheal tube. You will observe spontaneous respiration via a mask for a few moments, and then place a simple oxygen mask or nasal cannula. After

disconnecting the monitors and moving the patient along with their IV lines, urinary catheter, and any other attached items to a stretcher, you are ready for transport to the post anesthesia care unit (PACU; "recovery room.")

What will you do on arrival to the PACU?

Depending on the local procedures at your hospital, you may assist the PACU nurses in getting the patient "settled" by reestablishing hemodynamic monitoring, verifying adequate pain control and absence of nausea, and checking for stable vital signs. You will give a brief report of the procedure and your anesthetic course, fluid totals, analgesics and antiemetics to the PACU nurse. You will ensure that orders are present for maintaining analgesia, and rescue orders for breakthrough pain or nausea.

Congratulations on completing your first anesthetic!

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Recommended Anesthesiology Educational Resources

1. Society for Education in Anesthesia (SEA). https://www.seahq.org/page/Student
2. Anesthesia and Critical Care Reviews And Commentary (ACCRAC) podcast, which is available on almost any podcast platform or at http://accrac.com/
3. Open Anesthesia. https://www.openanesthesia.org/
4. Stanford CA1 Tutorial. http://ether.stanford.edu/ca1_new/
5. Medical Student Anesthesia Primer. http://www.anesthesia-education.com/primer.doc

Support and Resources for Those Experiencing Depression, Substance Abuse, or Thoughts of Suicide

1. National Suicide Prevention Lifeline. Call 988 or visit https://988lifeline.org/about/

2. Substance Abuse and Mental Health Service Administration. Call 1-800-662-4357 or visit https://www.samhsa.gov/find-help/national-helpline
3. American College of Physicians: Resource on Physician Suicide and Depression. https://www.acponline.org/practice-resources/physician-well-being-and-professional-fulfillment/physician-suicide-and-depression-resources
4. Compilation of podcasts and videos by the Council of Residency Directors in Emergency Medicine. https://www.cordem.org/resources/professional-development/wellness%2D%2Dresilience%2D%2D-resources-page2/NPSA/podcasts%2D%2Dvideos/

Suggested Educational Resources

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