A Brief Guide to Anesthesia and Surgery for the Intelligent Patient

A Brief Guide to Anesthesia and Surgery for the Intelligent Patient:

Going Under

By

D. John Doyle

Cambridge Scholars Publishing

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To Jo-Anne Taylor Williams, my wife of four decades, our son Jonathan, and the many patients I have been privileged to serve.

AI USE NOTE: Several AI services were used in the preparation of this manuscript. Grammarly was used for real-time spelling and grammar correction. Elicit.org, OpenEvidence.com, and PubMed.gov were used to find peer-reviewed studies and reviews. ChatGPT was used for proofreading and critical commentary purposes. Any AI-generated text was personally reviewed and edited for correctness.

Table of Contents

EPIGRAPH

"Alcohol is the anesthesia by which we endure the operation of life."

— George Bernard Shaw

About the Author

I graduated from the University of Toronto Medical School in 1982 and pursued a residency in anesthesiology in the years that followed, obtaining Board Certification in Canada (1986) and in the US (1989), respectively. I spent the years that followed in the realm of "academic" anesthesia, working in the operating rooms of teaching hospitals, supervising anesthesia residents and medical students, and engaging in research activities driven by personal and professional interests **(Figure 0-1)**. Now (2025), I am mostly retired, finally giving me time to complete various "bucket list" projects, such as completing this book project.

Over my decades of practice, I have observed many new developments in the Operating Room (OR). In the four decades since my MD graduation, I have been witness to numerous important developments in surgery (e.g., laparoscopic procedures, robotic surgery, facial transplantation), in anesthesia (e.g., advanced patient monitors, sometimes incorporating simple Artificial Intelligence), and in Operating Room team-development (e.g., standardized protocols, formal surgical sign-in procedures). Undoubtedly, these developments have greatly contributed to a contemporary surgical and anesthetic experience better than was available in the past[1].

D. John Doyle MD PhD DPhil

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[1] While surgery and anesthesia have become safer than ever, two factors must be noted. First, we now sometimes agree to take on challenging cases that would not have been offered surgery in earlier decades; this fact necessarily increases perioperative mortality in comparison to a setting where extra risky cases are still declined. A second matter is that while the safest possible surgical and anesthetic experience is desirable, the reality is that the degree to which the necessary support for this goal is available largely depends on the particular national and local healthcare system to which the patient is connected.

PREFACE / FOREWORD

Facing surgery can be one of the most daunting experiences in a person's life. The thought of placing your body in the hands of a surgical team and undergoing general anesthesia — where you surrender consciousness and control — may stir up feelings of anxiety, vulnerability, and fear of the unknown. These emotions are normal, but they don't have to define your experience. With the right information and preparation, the mysteries surrounding anesthesia and surgery can be unraveled, allowing you to approach surgery with confidence and understanding.

This book was born out of the need to provide clear and compassionate answers to the questions many patients and their families have about anesthesia and surgery. While we often hear detailed explanations of the surgical procedure itself, the intricacies of anesthesia — the very thing that keeps you pain-free and comfortable during surgery — are sometimes less well discussed. Anesthesia can feel like a black box: one moment you're awake, and the next, you're not. What happens in between? How does it work? What are the risks? And perhaps most importantly, what can you expect before, during, and after your surgery?

"Going Under" is a guide written for the intelligent general public — those who want more than a surface-level explanation. Whether you're facing surgery yourself or caring for a loved one, this book will provide you with the knowledge and tools to navigate the process of anesthesia and surgery with a sense of control. We'll explore the different types of anesthesia, the role of the anesthesiologist and his or her team, potential risks, side effects, and the recovery process. You'll learn what to expect at each stage, from your initial consultation to the moment you wake up after surgery, to your return home.

This book also addresses many of the most common concerns voiced by patients: "Will I wake up during surgery?"; "Will I experience any pain?"; "How long will it take to recover?" These questions, often left lingering, deserve honest answers. With each chapter, we aim to dispel myths, clarify uncertainties, and provide practical advice that empowers you as a patient.

Some patients ask only a few questions when seen preoperatively, sometimes inquiring only about parking availability. For some patients, this may be because they don't want to hear the "gory" details and because they have complete trust in the system they have engaged with. The care provided to these patients (patients who uncritically pass through the system) is almost always just as good (and at times better) than the care provided to patients who spent countless hours researching all possible details of the associated surgical and anesthetic issues that a proposed surgical procedure entails. I say "at times better" because there are surgeons and anesthesiologists who, in their unending respect for patient autonomy, will agree to unreasonable or suboptimal conditions that they would never advise if the patient were a friend or a family member.

On that particular matter, one example I remember well concerns a very popular female obstetrician with a busy practice whose patients loved her dearly because she was so eager to make the obstetrical experience as pleasant as possible for the patient and her family. The case concerned a parturient in early labor who "forbid" the use of Cesarean section surgery to deliver the baby, with the particular details not being specified in complete legal detail (e.g., what to do if prolonged fetal bradycardia occurred, what if labor started to fail, etc.) When the delivery didn't go as planned, the obstetrician advised the patient that a Cesarean section should be carried out, but given her respect for the parturient's wishes, the obstetrician did not argue for the surgery as strenuously as others might. When the baby was finally delivered following a lengthy forceps delivery, he came out flat and unresponsive, not crying at all. Fortunately, the neonatologists did a fine job of resuscitating the kid and transporting him to the NICU (neonatal ICU). As to the eventual outcome for the child, I never found out, but the likelihood of some injury (e.g., brain damage) is always a concern in cases like this. (Note that a popular scoring system for evaluating newborns is the neonatal Apgar score [2]).

Anesthesia is a remarkable field of medicine — one that has made modern surgery possible and safer than ever. The term "anesthesia" was first introduced in 1846 by the American physician and writer Oliver Wendell Holmes Sr. after the successful demonstration of ether as a surgical anesthetic by dentist William T.G. Morton. Holmes coined the word by combining the Greek words "an" (meaning "without") and "aisthēsis" (meaning "sensation" or "feeling"), effectively meaning "without sensation." This term was intended to capture the state of total insensibility that had now become possible with the use of inhaled ether. Ether allowed

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[2] For details on the Apgar neonatal scoring system, visit https://www.healthline.com/health/apgar-score

patients to undergo surgery without the agony and awareness that had previously accompanied such procedures. Holmes's suggestion marked a milestone in medical history, as the concept of pain-free surgery reshaped the possibilities of medical intervention.

Thanks to developments over time, anesthesia has become safer than ever. But with that safety comes the responsibility of making informed decisions and understanding the process you're about to undergo. I hope that by the time you reach the end of this book, you'll feel less intimidated by the prospect of anesthesia and surgery and more equipped to have meaningful conversations with your healthcare team.

One final point. It is my goal to have the reader become comfortable with a bit of medical jargon, with terms like "analgesia" and "respiratory depression" used freely in the text after being originally introduced. This extra bit of language precision should provide the reader with a deeper appreciation of clinical matters. Additionally, the included Glossary **(Appendix A)** will assist readers encountering some terms for the first time.

Welcome to "Going Under." Let's take the journey together.

Figure 0-1. Photograph of the author taken while working at Cleveland Clinic. The instrument near the left side of my head is a brain activity monitor, in which both raw EEG (electroencephalogram, "brain wave") signals can be visually examined as well as processed electronically to produce a "depth of anesthesia" metric (0=flat EEG; 100=fully awake). The smaller instrument next to my left ear measures the degree of muscle relaxation; relaxed muscles, among other things, make the surgeon's job a bit (or a lot) easier.

Chapter One

What is Anesthesia?

Anesthesia represents one of the most important advances in the history of medicine, allowing complex and life-saving surgical procedures to be performed without pain or distress. But despite its obvious importance, anesthesia remains a deep mystery to many. We may understand that it "puts you to sleep" or "numbs the pain," but beyond that, the details can be vague. What exactly is happening when you're under anesthesia? How does it work, and what role does it play in the overall surgery process?

In this chapter, we'll explore the fundamentals of anesthesia: what it is, how it's administered, and why it's so essential to modern medical care. By the end of this chapter, you'll have a clearer understanding of what happens when you "go under," and what you can expect before, during, and after anesthesia and surgery.

The Definition and Purpose of Anesthesia

At its core, anesthesia is a controlled and reversible neurological state that prevents you from feeling pain during a medical procedure. Anesthesia allows surgeons to perform delicate and complex operations that would otherwise be impossible due to the pain and movement involved. Depending on the type of anesthesia, it can render you unconscious, sedate you to the point that you are prevented from remembering the procedure, or simply numb (render insensate) a specific region of your body.

Most major surgery requires that you go to sleep (general anesthesia). Examples here are open heart surgery to repair a valve or to repair a big aneurysm (bulging) in the aorta by opening the abdomen[1]. Other cases might be better done under regional anesthesia, discussed later in this chapter. In many cases, the anesthesiologist will know exactly what anesthetic technique he or she prefers given your clinical circumstances and

[1] Note that in many cases abdominal aneurysms are repaired endoscopically via the femoral artery, without the need for full general anesthesia.

may not offer you much in the way of flexibility. On the other hand, there are often times when a variety of anesthetic techniques will be suitable and input from the patient is relevant. Also, the anesthetic technique preferred will depend on the clinical experiences of the anesthesiologist and the institution in which he or she works.

There are three main purposes of general anesthesia[2]:

1. **Pain relief (analgesia):** Preventing pain during the surgery and postoperatively.

2. **Unconsciousness (hypnosis):** Rendering the patient unaware of what's happening during the procedure.

3. **Immobility (muscle relaxation or paralysis):** Reducing movement during surgery to give surgeons better control and access.

These three effects — pain relief, unconsciousness, and immobility — can be achieved in varying degrees depending on the type of anesthesia used, which we'll cover in more detail next.

The Three Major Types of Anesthesia

The three major types of anesthesia are: local, regional, and general. Each type of anesthesia is chosen based on the procedure and the patient's needs, ensuring safety and comfort.

Local Anesthesia

A local anesthetic such as lidocaine or procaine (Novocain), when injected into tissue such as the area surrounding a tooth, will render the area insensible (i.e., make it numb) for a while, the exact duration varying with drug selection and other factors **(Figure 1.1)**. Local anesthesia is commonly used for minor procedures, such as toenail removal, to numb a specific area and reduce pain. In real life in operating rooms and doctor's offices,

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[2] Some authorities go beyond analgesia, unconsciousness and muscle relaxation as the principal goals of general anesthesia. They add amnesia (no memory of events) and physiological stability (homeostasis) to the goals of general anesthesia. Furthermore, some authorities argue that immobility should be stated as the third goal, rather than muscle relaxation or paralysis, since immobility can often be achieved without paralytic drugs.

lidocaine is the "go-to" drug to use for local anesthesia. Local anesthesia has even been used by a surgeon to operate on himself to remove his inflamed appendix (**Figure 1.2**). While popular in the movies, in real life, Novocain (procaine) is actually used infrequently outside of dentistry.

Most local anesthetics work by preventing the nerves in your body from sending pain signals to your brain, specifically by blocking "ion channels" in nerve cells (neurons). Epinephrine (Adrenalin) is often added in small amounts to the lidocaine to prolong its duration of effect. Sometimes the result is that the patient's heart speeds up. This is ordinarily not an issue, but it is worth remembering that patients with poor-quality heart vessels (think atherosclerosis) may not always tolerate big increases in heart rate.[3]

What happens if you give too much local anesthetic? Some types of trouble are heralded by the patient feeling strange sensations, such as the lips becoming numb or a sense of impending doom. Extreme trouble is sometimes encountered with some overdoses and generally falls into two types: the occurrence of seizures and the occurrence of cardiovascular collapse. While both can be fatal, experts in the field have offered remedies. One remedy for local anesthetic toxicity is to infuse intralipid, the same stuff that propofol is dissolved in. There was even an internet portal where emergency treatment information could be obtained in a flash: www.lipidrescue.org, but the site is now inactive, possibly the result of regulatory matters.

Regional Anesthesia

The idea of using regional anesthesia to reversibly "block" the nerve supply to some particular region using local anesthesia dates back many decades. Regional anesthesia can now be precisely applied using anatomical landmarks, ultrasound or X-ray imaging. Gentle sedation is often additionally administered to ensure patient comfort, typically by using some combination of midazolam, fentanyl, propofol or whatever is being promoted at national medical meetings.[4] **Figure 1-3** shows the results of an

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[3] The problem here is that blood through the heart's arteries takes place mostly in the resting part of the cardiac cycle (diastole), and speeding up the heart with epinephrine both reduces the period of diastole as well as increases the per-minute energy requirements of the heart.

[4] Just kidding about drug promotion at national medical meetings. However, go to https://www.policymed.com/2021/08/opdp-to-study-promotion-of-prescription-drugs-at-hcp-conferences.html to explore this matter in more detail.

orthopedic surgery operation where regional anesthesia would commonly be used.

Blocks are done while the patient is awake in most adults, for safety reasons. The "king" of regional anesthesia is the **spinal**, but its use is generally limited to stuff done below the belly button. Still, spinals cover enough to allow lower-extremity procedures like hip surgery, as well as numbing enough to allow Cesarean section surgery. With spinals, drugs are injected into the subarachnoid space that contains the cerebrospinal fluid (CSF) bathing the spinal cord.

Related to the spinal is the **epidural**; the difference is that while the drug in a spinal is placed in the fluid surrounding the spinal cord, in the case of an epidural the drug is placed in the epidural space **(Figure 1-4)**. Epidural anesthesia typically involves placing a catheter (narrow-bore tube) into the epidural space and placing local anesthetic solution in this space via the epidural catheter. The technique is commonly used in obstetrics to reduce the pain of Stage II labor contractions, but it also works for many lower-extremity operations. Here the catheter is often placed at the L3-L4 spinal interspace, but other locations may be appropriate for other procedures, such as placing a thoracic epidural for pain relief after lung cancer surgery.

Ultrasound

For blocking nerves in arms and other structures, it is common to use an ultrasound imaging machine to find the nerves one seeks to block **(Figures 1-5 and 1-6)**. Here, the anesthesiologist directs a special needle toward the nerve using the ultrasound image being displayed. There are a great many available upper extremity and lower extremity blocks, many with full-quality instructional videos available on YouTube. Still, many patients prefer general anesthesia over anything else if they need to undergo complex or lengthy surgery.

Is regional anesthesia safer than general anesthesia? That question is a frequent debate topic at anesthesia conferences; overall, the two seem to be "even-steven" overall. But with new studies popping up all the time, the question may eventually end up with a different answer.

Sedation

Sedation is often administered in conjunction with regional anesthesia. Commonly used IV sedative drugs in this setting include midazolam

(Versed), fentanyl, propofol (often as an infusion), and dexmedetomidine (Precedex).

Sedatives administered in the Operating Room or ICU are usually delivered through an IV and can be classified into three levels:

- **Mild Sedation:** The individual remains awake and responsive, but anxiety is reduced (anxiolytic effect).

- **Moderate Sedation:** The individual may feel drowsy or fall asleep but can be easily aroused.

- **Deep Sedation:** The individual is in a deep sleep, similar to general anesthesia, but typically does not require full airway and breathing support.

Sedation and general anesthesia are both forms of anesthesia, but they differ significantly in their effects. Sedation generally leaves a person in a relaxed state of consciousness, feeling drowsy but still able to respond to stimuli in most cases. In contrast, general anesthesia results in a complete loss of consciousness, rendering the individual unresponsive and requiring close monitoring and (often) full breathing support.

Cardiovascular function is typically maintained during sedation, and individuals can usually breathe independently, although respiratory assistance may be necessary in some cases. As just noted, however, general anesthesia usually impairs spontaneous breathing, often requiring ventilatory support and continuous monitoring. Simple sedation has the advantage of a quicker recovery period compared to general anesthesia and avoids many of the adverse effects associated with full anesthesia.

General Anesthesia

For a long time, the proposed mechanism by which anesthesia worked was simply wrong. The original reigning concept was that the administered anesthetic molecules ended up embedded in nerve tissue so as to disrupt the cell membrane of the neurons. The idea was that by expanding the cell membrane, anesthetics interfered with neuronal operation, altering their “electro-ionic” properties. Now we know that anesthetic agents don’t mess up nerve cells and their membranes *per se* as much as they operate via the receptor-based activation or deactivation of specific neuronal circuits in the brain.

In 1986 a different explanation emerged, backed by good science. It was discovered that anesthetics act mostly by activating associated molecular receptors, as in the **GABA receptors** involved in maintaining consciousness or the **mu-receptors** that mediate pain and bring on a euphoric mental state **(Figure 1-7)**. These receptors are central parts of various brain signaling circuits (neural networks) present in the brain. These neural networks are sometimes described as dopamine networks, serotonin networks, and so on, based on the molecules ("neurotransmitters") flowing around each of the brain's various signaling pathways. Agents that induce general anesthesia ultimately seek to target some particular signaling network whose ongoing operation is needed to maintain consciousness. Current research now focuses on the details.

We now know that brain circuitry operation is all about neurotransmitters. and that excesses or deficiencies of neurotransmitters can produce clinical problems. One example is dopaminergic neural networks experiencing a dopamine deficiency in Parkinson's disease. Another example is the neurotransmitter acetylcholine normally binding to matching molecular receptors in muscle tissue in the operation of skeletal muscle. However, Myasthenia Gravis disrupts this process due to autoantibodies targeting those receptors, leading to impaired neuromuscular transmission and muscle weakness.

Finally, note that knowing the necessary conditions for an anesthetic molecule to work doesn't explain all the details and molecular mechanics. Fortunately, one can generally use a drug safely without fully understanding the inner workings and pathways of the biochemistry involved. Indeed, a drug might be wonderfully safe and effective but without much knowledge of the specific molecular pathways the drug affects.

Anesthetic Drugs

Many people think that the anesthesiologist "gives you a needle", you go off to sleep, and then sometime later you wake up, and that is all there is to it. Nothing could be further from the truth; administering a good anesthetic involves the wide use of many drugs in what some people call "polypharmacy at its very best." The following will give you an outline of how the procedure of giving an anesthetic is actually done.

Once you are brought into the Operating Room, an intravenous (IV) is started (or started earlier), and several monitors are hooked up. In very major cases, special monitors, such as catheters (monitoring lines) going into the heart or into an artery (commonly the radial artery in the wrist) for blood pressure measurement, may be used. As well, if a lot of blood is expected to be lost, more than one intravenous line is commonly started. After the anesthesiologist has checked his or her anesthesia machine and surveyed the environment in which he or she is working to ensure everything is in place, the patient is given oxygen by face mask, and a number of drugs are given to start the induction of the anesthetic **(Figure 1.8)**. Typically, this will involve a drug ("hypnotic") such as propofol to help you to go to sleep (induce general anesthesia), then followed by a "muscle relaxant" such as rocuronium to relax all the patient's muscles.

With muscle relaxation, the patient is more or less completely paralyzed, totally unable to move. This, of course, would be a horrible experience if one is awake, but it is only done after the propofol is given so that you are unaware of this. The reason the muscle relaxant is given is that it makes it much easier to put in a breathing tube (endotracheal tube); this is usually introduced with the assistance of an instrument called a laryngoscope (discussed later) that allows one to see all the airway structures in the pharynx and throat.

Later on, muscle relaxation may be needed to facilitate the surgeon's work. With the introduction of the breathing tube (endotracheal tube), the patient is then usually hooked up to a ventilator (breathing machine), which breathes for him or her during the surgery. Very often, additional medications to keep you asleep are introduced through the anesthetic breathing tube. These may include nitrous oxide ("laughing gas"), typically in a concentration in the range of 60% to 70%, accompanied by oxygen for the balance, and with a "potent inhalational anesthetic agent" such as sevoflurane or isoflurane. For example, 1% isoflurane or 2% sevoflurane is commonly used to keep people asleep[5]. This is called the "maintenance" phase of the anesthetic. Not infrequently, these potent inhalational agents will be used in conjunction with opioid analgesics like fentanyl or morphine to keep the pain to a minimum. The anesthesiologist continually monitors the depth of anesthesia during the procedure and adds more drugs as he or she sees fit to keep the appropriate level of anesthesia and the appropriate level of surgical muscle relaxation.

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[5] While we frequently say that the patient is "asleep" during general anesthesia, the reader should bear in mind that general anesthesia and ordinary sleep are completely different physiological states.

Staying Awake

Many patients have a fear of general anesthesia and would prefer to be awake for their surgery, especially if the case is easily done using local anesthesia. More commonly, however, the opposite is true, and patients prefer to be asleep throughout the surgical procedure. In this matter, not all surgery requires that patients undergo general anesthesia; many procedures can be done under pure local anesthesia, such as many minor cosmetic surgical procedures, although frequently some intravenously administered sedation is given, as discussed earlier. Frequently, a Versed-like drug (benzodiazepine) is given to provide sedation. Alternatively, sedating narcotics (opioids) like fentanyl may be given; these will make you sleepy and will also reduce pain.

Further Reading (Open Access)

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Sgourdou P. The Consciousness of Pain: A Thalamocortical Perspective. NeuroSci. 2022 May 25;3(2):311-320. doi: 10.3390/neurosci3020022. PMID: 39483367; PMCID: PMC11523681.

Figure 1-1. This image shows a maxillary infiltration anesthesia technique, where a dental syringe with a fine-gauge needle is used to administer a local anesthetic to the tissue above the maxillary teeth, targeting the superior alveolar nerves. The practitioner's hand steadies the syringe to deliver the anesthetic precisely near the alveolar bone, ensuring diffusion into the target area for effective numbness while minimizing trauma to adjacent tissues. A metal appliance, positioned in the background, assists in retracting tissue to improve visibility and access. This technique is commonly employed for minor dental procedures requiring localized anesthesia, offering effective pain control with minimal risk of nerve or vascular complications when properly administered.

Image Source:
https://commons.wikimedia.org/wiki/File:DentalLocalAnesthesia11-26-05.jpg

Figure 1-2. Dr. Leonid Rogozov, then a 27-year-old Soviet physician, performed a remarkable act of self-surgery on April 30, 1961, when he removed his own appendix while stationed in Antarctica. Rogozov was part of the Soviet Antarctic Expedition and the only doctor at the isolated Novolazarevskaya Station. He developed acute appendicitis, a potentially life-threatening condition if untreated, and evacuation was impossible due to severe weather and lack of nearby medical facilities. Faced with few options, Rogozov decided to operate on himself, demonstrating extraordinary courage and medical skill. He used local anesthesia, a mirror, and the assistance of two colleagues, who helped position a mirror, adjusted the lighting, and handed him instruments when needed. The self-surgery took nearly two hours, with Rogozov making a 10-12 cm incision and carefully removing the inflamed appendix while monitoring his own vital signs and managing symptoms of weakness and nausea. The operation was successful, and he recovered without complications, resuming his duties within two weeks. Rogozov's self-surgery became legendary in both medical and popular circles, symbolizing the resilience and ingenuity of physicians working under extreme conditions.

Image Credit: https://imgur.com/ORYUQYK

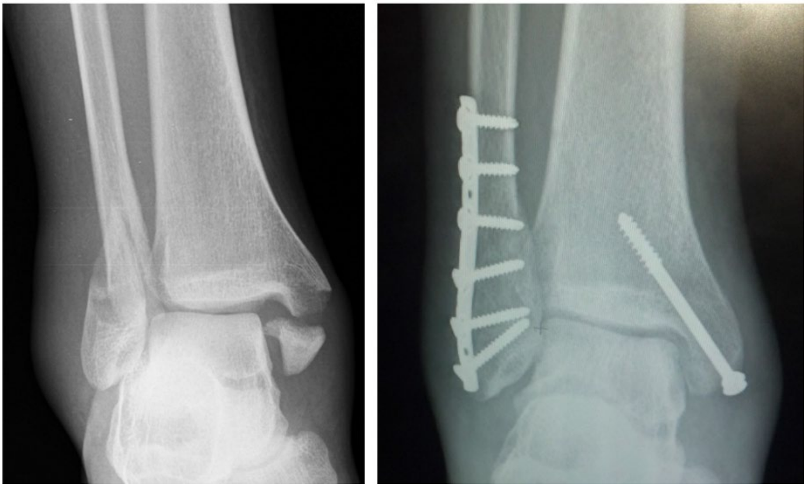

Figure 1-3. The image presents a "Before" and "After" X-ray comparison of a treated (plate and screw insertion) trimalleolar ankle fracture, as seen in X-ray images. The "Before" image on the left shows a fractured distal tibia and fibula, indicative of a serious injury, likely due to trauma. The "After" image on the right displays the same ankle following surgical intervention, where internal fixation has been performed using metal plates and screws to realign and stabilize the bones. This type of surgery, known as open reduction and internal fixation (ORIF), is commonly performed to ensure that the fractured bones heal in the correct alignment, restoring the normal function of the ankle. The screws and plate hold the bones in place, allowing them to heal properly over time. The X-rays demonstrate the effectiveness of this surgical approach in correcting the fracture, which is essential for regaining mobility and preventing long-term complications such as arthritis or instability in the joint. The clear contrast between the two images highlights the crucial role of surgical intervention in treating severe fractures.

Image Source:
https://commons.wikimedia.org/wiki/File:Trimalleolar_Ankle_Fracture_Xray_shown_before_surgery_and_after_surgery.png

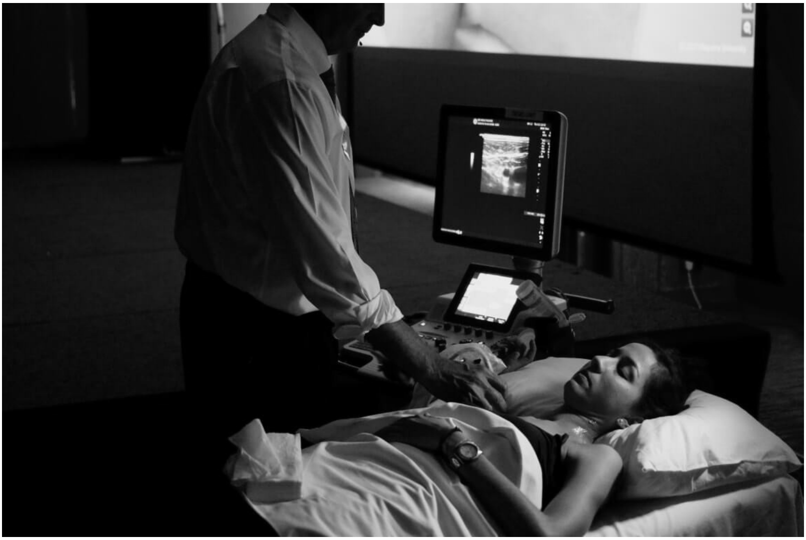

Figure 1-4. This image shows an ultrasound-guided brachial plexus block procedure being performed. The patient has their head turned slightly to allow access to the area where the brachial plexus nerves are located, near the neck and shoulder. The anesthesiologist on the left is using an ultrasound imaging machine to visualize the nerves and guide the injection of anesthetic precisely to the brachial plexus. In an ultrasound-guided block, the provider places a transducer (ultrasound probe) on the patient's skin over the target area to locate the nerves. The real-time imaging provided by the ultrasound allows for accurate needle placement and anesthetic delivery, enhancing the safety and efficacy of the block. This technique is commonly used for surgeries on the upper extremity as it provides effective regional anesthesia while minimizing the need for systemic sedatives or general anesthesia. The display of the nerves and surrounding structures on the ultrasound screen ensures precise administration, reducing the risk of complications.

Image Source:
https://commons.wikimedia.org/wiki/File:NYSORA_Dubai_Symposium.jpg

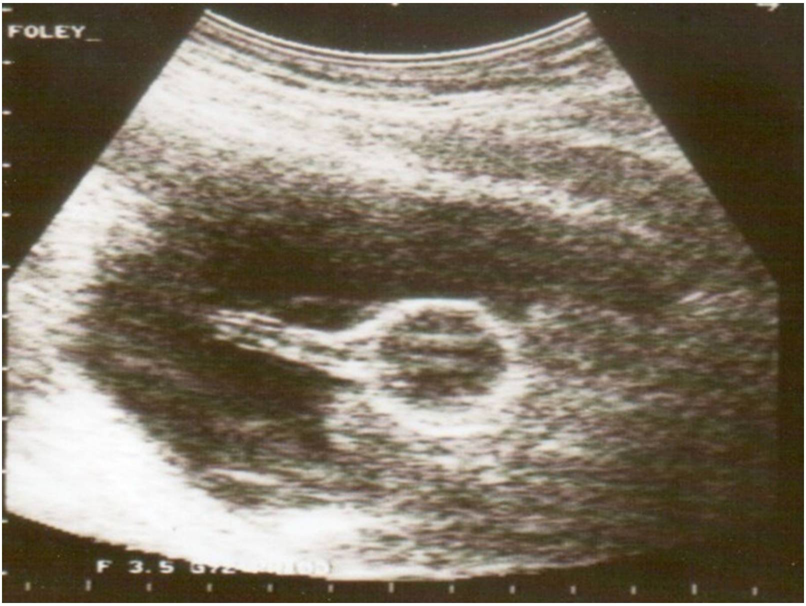

Figure 1-5. Ultrasound image of a urinary bladder containing an indwelling Foley catheter with an inflated retention bulb. Similar ultrasound imaging techniques allow anesthesiologists to identify target nerves and to direct a needle towards the nerve using the real-time image for guidance. Once the needle is positioned correctly, local anesthesia is injected in the vicinity of the nerve to initiate the block.

Image Credit:
https://upload.wikimedia.org/wikipedia/commons/d/dd/Ultrasound_Scan_ND_013.jpg

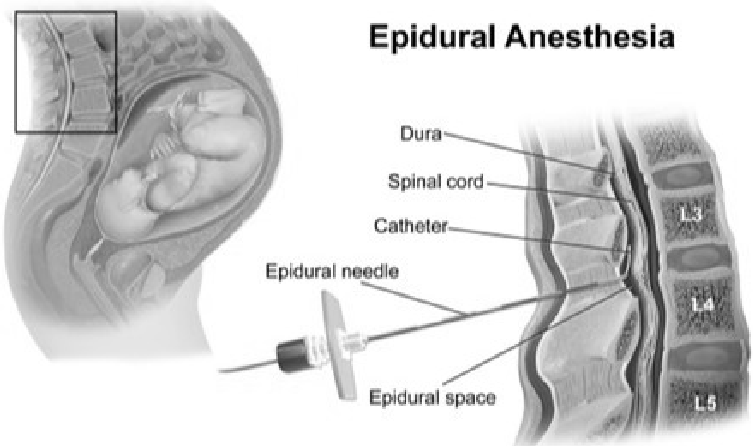

Figure 1-6. This image illustrates the process of administering epidural anesthesia, commonly used for pain relief during labor and certain surgical procedures. The diagram shows the placement of an epidural needle and catheter within the lumbar region of the spine, typically between the L3 and L4 or L4 and L5 vertebrae. The needle is carefully inserted into the epidural space, which lies outside the dura mater that encases the spinal cord. Once in position, a catheter is threaded through the needle and left in place to deliver anesthetic agents, providing localized nerve blockade. This targeted approach allows the anesthetic to block the transmission of pain signals from the lower body to the brain without affecting consciousness, offering effective pain management while maintaining motor function to a variable extent, depending on the dosage and type of medication used. The anatomical precision in positioning the needle and catheter is crucial to avoid puncturing the dura, which could lead to complications such as cerebrospinal fluid leakage.

Image Credit:
https://upload.wikimedia.org/wikipedia/commons/0/08/ Epidural_Anesthesia.png

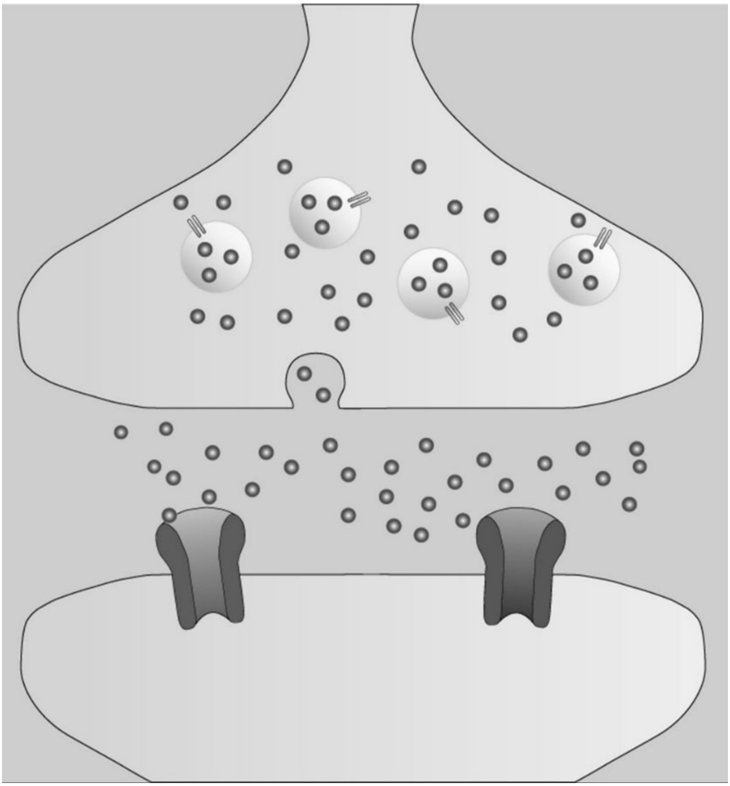

Figure 1-7. Illustration of neurotransmitter molecules (dots) contained within synaptic vesicles (larger circles). In passing along a signal, neurotransmitter molecules are released into the space between two cells (synaptic cleft), subsequently binding to matching postsynaptic receptors on the other side to pass along a signal of some kind. Once in the synaptic cleft, the neurotransmitters diffuse across the space and bind to molecular receptors on the membrane of the postsynaptic neuron (shown at the bottom). The binding of neurotransmitters to these receptors leads to a change in the postsynaptic cell's membrane potential, either exciting or inhibiting the neuron, depending on the type of neurotransmitter and receptor involved. This process is fundamental to synaptic transmission, which underlies all neural communication and is essential for functions ranging from muscle contraction to cognition. The synapse is a critical site of modulation in the nervous system, where the strength and efficacy of neural signals can be adjusted, playing a key role in learning, memory, and other complex brain functions. Anesthetic agents and several other molecules act at various receptors, altering the properties of the receptor and the neuron it serves. Molecules that bind to receptors can be agonists (triggering an action within the cell), antagonists (preventing an

action within the cell), or have mixed properties. As an example, morphine molecules attach to so-called mu receptors to relieve pain. Naloxone (Narcan) molecules displace morphine and other opioid molecules attached to these mu receptors to help reverse opioid overdoses.

Image used under a Creative Commons license.

Image Credit: https://upload.wikimedia.org/wikipedia/commons/f/fe/Synapse-Neurotransmitter_Release.png

Figure 1-8. The administration of general anesthesia typically involves the intravenous administration of a variety of drugs administered at various stages of the surgery, as well as inhaled agents like isoflurane or sevoflurane. This image displays a set of drug syringes, each labeled with the name and concentration of different medications commonly used in anesthesia. The syringes include propofol, fentanyl, atracurium, and glycopyrrolate (Robinul), drugs administered during surgery for inducing and maintaining anesthesia, providing pain relief, muscle relaxation, and controlling heart function. The precise labeling and arrangement of the syringes highlight the importance of careful preparation and organization in the operating room, ensuring that the anesthesia team can efficiently and safely administer these

medications as needed. This image underscores the meticulous attention to detail required in anesthesia management, where the correct dosage and timing are crucial for patient safety and the success of the surgery. Note that a preprepared label for the second syringe was not available and so was hand-made. Also, many individuals add the current date and time to each drug label. The white-colored drug in the big syringe is propofol, the drug that killed Michael Jackson.

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Image Source:
https://commons.wikimedia.org/wiki/File:Anesthesia_medications.JPG

CHAPTER TWO

PREPARING FOR ANESTHESIA AND SURGERY

Preparation is key to ensuring a smooth and safe experience with anesthesia and surgery. Whether you are undergoing a minor procedure or major surgery, the steps you take before entering the operating room can impact on your outcome. Many people are unaware of the need for planning that goes into preoperative care—planning should start long before the day of the surgery itself. An important example is to cover the possibility that some medications should be discontinued preoperatively[1]. From pre-operative consultations to lifestyle adjustments, this chapter will guide you through what to expect and how to prepare for anesthesia, giving you the confidence to approach your surgery with peace of mind. The chapter also offers a pre-surgery patient checklist **(Table 2-1)**, and a list of commonly asked questions by patients, categorized into the preoperative, intraoperative, and postoperative periods **(Table 2-2)**.

The Preoperative Anesthesia Visit

Patients scheduled for anesthesia and surgery often visit a preanesthesia clinic to make sure that everything goes smoothly. Such a visit typically takes well under an hour but can take much more depending on your medical history, the type of surgery planned, and whether additional testing is indicated (blood tests, x-rays, electrocardiogram, etc.). During the visit, pertinent medical problems are reviewed and a tentative anesthetic plan is developed. The visit also affords an opportunity to have any questions answered. The importance of fasting for eight hours or more before anesthesia is also emphasized (discussed in more detail later).

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[1] For instance, GLP-1 agonist agents like Ozempic (semaglutide) or Mounjaro (tirzepatide), commonly used for weight loss, should be discontinued at least 1 week before anesthesia. Similar considerations apply to individuals taking "blood thinners" to reduce their risk of a blood clot.