Introduction

A *very* short history of anesthesia

Every now and then, you run into a high-school student who did a paper on the history of anesthesia, or the teacher who assigned it. Here are a few facts and dates that should keep you out of acute embarrassment.

God was first: "And the Lord God caused a deep sleep to fall upon Adam, and he slept." (Genesis 2:21). A date is not given.

Anesthesia as we know it started in the early to mid 1840s.

Crawford Long of Jefferson, Georgia, removed a small tumor from a patient under diethyl ether anesthesia. That was in 1842. Crawford Long failed to publish this event, and he was denied the fame of having been the first to use diethyl ether as a surgical anesthetic. Ether was not unknown; students inhaled it during the so-called ether frolics.

Horace Wells had used nitrous oxide in his dental practice. In 1844, he failed to demonstrate the anesthetic effects of N_2O in front of a critical medical audience. The patient, a boy, screamed during the extraction of a tooth, and the audience hissed. Later, the boy said that he had not felt anything. Excitement under light nitrous oxide anesthesia is common. Horace Wells died young and by his own hand.

William T. G. Morton, another dentist in anesthesia's history, successfully etherized a patient at the Massachusetts General Hospital in Boston on *October 16, 1846*. The news of this event spread worldwide as rapidly as the communication links permitted. Morton tried to patent his discovery under the name of Letheon. An English barrister later wrote: "a patent degrades a noble discovery to the level of a quack medicine."[1]

Oliver Wendell Holmes, only 2 months after Morton's epochal demonstration of surgical anesthesia, suggested the term "anesthesia" to describe the state of sleep induced by ether. Holmes was a physician, poet, humorist and, fittingly, finally dean of Harvard Medical School.

John Snow, from London, became the first physician to devote his energies to anesthetizing patients for surgical operations. His earliest experiences with ether anesthesia date to late 1846. In 1853, he administered chloroform to Queen Victoria for the delivery of her son Prince Leopold. This shook the acceptance of the divine command: "in sorrow thou shalt bring forth children" (Genesis 3:16) and thus powerfully furthered the use of anesthesia to alleviate the pain of childbirth. Incidentally, while anesthesiologists admire John Snow for his publications and the design of an etherizer, epidemiologists claim him as one of their own because he had recognized the source of a cholera epidemic, which he traced to a public pump. By removing the pump's handle, he stopped the spread of the infection. That was in 1854.

Those were the beginnings. By now, the two earliest anesthetic vapors, diethyl ether and chloroform, have been modified hundreds of times. Many descendants have come and gone, but their great-grandchildren still find daily use. Intravenous drugs have secured an increasingly prominent place in anesthesia, among them neuromuscular blockers – hailing back to South American Indians and their poisoned arrows shot from blowguns. A steadily growing pharmacopeia of analgesics, hypnotics, anxiolytics, and cardiovascular drugs now fill the drug cabinets.

We still listen for breath sounds, we still watch color and respiration, and we still feel the pulse, but today we are helped by the most subtle techniques of sensing invisible signals and the most invasive methods, with tubes snaking through the heart.

When we reduce the history of anesthesia to a few dates and facts, we do not do justice to the stories of the age-old and arduous struggle to alleviate pain. In one of the more comprehensive books on the genesis of surgical anesthesia, you will find a superb description of the interesting personalities and the many events that eventually paved the way to one of the greatest advances in medicine, the discovery of anesthesia.[2] The book brims with anecdotes, for example the story of a woman in 1591 accused of witchcraft. One of the indictments was for her attempt to ease the pain of childbirth. She was sentenced to be "bund to ane staik and brunt in assis (ashes), quick (alive) to the death." Why society's acceptance of pain relief changed and how obstetrical anesthesia eventually developed is the subject of another great historical book by Donald Caton.[3]

Notes

1 You will find this quotation in one of the three delightful volumes entitled *Essays of the First Hundred Years of Anaesthesia* by W. Stanley Sykes, who relates the most wonderful stories having to do with anesthesia. For example, did you know that to be eaten alive by a lion and the like might not be painful? Sykes, W. S. (1961). *Essays on the First Hundred Years of Anaesthesia*. Volume 2, pp. 75–79, E&S Livingstone Ltd, Edinburgh.

2 Norman A. Bergman (1998). *The Genesis of Surgical Anesthesia*. Wood Library – Museum of Anesthesiology, Park Ridge, Illinois.

3 Donald Caton (1999). *What a Blessing She Had Chloroform*. Yale University Press, New Haven and London.

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Excerpt
More information

Safety and quality in anesthesia

The specialty of anesthesiology came about in large part to reduce the unacceptable risk of death associated with the provision of surgical anesthesia by someone who wasn't specially trained in the field. Our goal is to shepherd each patient safely from pre-operative optimization, through intra-operative management and into a comfortable post-operative recovery. Thus it makes sense to begin our journey into the essentials of anesthesia by putting safety and quality in modern healthcare in perspective.

Safety in medicine has an illustrious history, of which we are reminded during medical school graduation ceremonies with the traditional recitation of the Hippocratic Oath (or perhaps a contemporary version). One of its central tenets, "abstain from doing harm", remains a core principle for physicians even 24 centuries later. But, alas, we are only human and errors, either gross ones – like injecting potassium too quickly or removing the wrong leg, or subtle ones – like antibiotics administered a few minutes after incision (instead of before) or an i.v. stopcock left uncapped inviting infection, do occur. Unfortunately these errors are not rare. In 1999 the Institute of Medicine estimated that almost 100 000 patients annually lost their lives in the USA due to medical errors; the equivalent of a fully loaded passenger jet crashing every day![1] Before this report pulled it all together we really had no idea of the magnitude of the opportunity for improvement. This report was in effect a call to arms and framed for us all the challenge that avoidable harm should and must be eliminated.

Anesthesia errors contribute only a small part to this staggering measure of harm inflicted on patients. This "success" is in large part due to the "early" (1980s) recognition by anesthesia leaders that the agents we administer, the procedures we perform, and monitoring lapses can have lethal consequences. The Anesthesia Patient Safety Foundation (APSF) was founded in 1985 with a vision "that no patient will be harmed by anesthesia." Its multidisciplinary approach (including physicians, equipment manufacturers, drug companies, and others) focused on preventing adverse clinical outcomes, especially those involving human error. The following year the American Society of Anesthesiology became the first medical society to adopt professional guidelines, and then standards, for its members.[2]

With a quiver full of assorted guidelines and standards to bring to bear on behalf of our patients, the anesthesiologist steps into the role of "patient protector." Our concerns for his safety start well before induction of anesthesia. We are very aware of the patient's fears and we use reassurance and, if necessary, drugs to prepare him for the trip to the operating room. Indeed, we administer potent drugs not only to allay fear and pain, but for induction and maintenance of sleep. As soon as we apply these drugs, safety concerns escalate. All the medications in our arsenal have potentially nasty side effects. We monitor a host of signals that tell us about the patient's well-being. We compensate as best we can for disturbances induced by the very drugs we use, as well as the often drastic perturbations triggered by the underlying pathophysiology of the patient, the operation, and operator. The transitions from awake to asleep (induction of anesthesia) and from anesthetized to self-sufficient (emergence) represent critical phases. We recognize the threat of latent problems during the recovery phase by using a post-anesthesia care unit (PACU, formerly called recovery room) where patients are closely watched. Indeed, we often care for patients even once they have left the operating room/PACU suite.

Clearly, we cannot hope for *certainty* of safety. We must make do with *relative* safety because all too many agents under defined (and some not defined) conditions can render unsafe the state in which the patient finds himself.

How safe is safe enough?

You might skip the discussion of this question as we have no good answers to offer. All too much depends on the shifting expectations of society and on the highly variable resources society makes available. As human beings we are not entirely "risk-averse," as we happily exchange certain safety for the risk of breaking bones or even killing ourselves while schussing down a black diamond slope, eschewing our seatbelt, jumping out of a perfectly good airplane, riding a motorcycle, or smoking or overeating. We also voluntarily face risks while working in a mine or serving in the military or living in a house exposed to radon. The list is long and interesting and ranges from minimal to dangerously high risks.

Societal assessment of risks and safety changes over time. In 1938 the March of Dimes was founded to fight poliomyelitis, with an incidence of 1 in 13 600. At that time anesthetic deaths garnered little or no attention. Even 16 years later when Beecher and Todd reported a death rate of about one in 2000 anesthetics, society paid little attention, yet annually more people died from anesthesia than from polio. Yet no march or even rally to reduce anesthetic mortality was held.

Advance the calendar three decades and enter the era of costly malpractice suits brought against anesthesiologists and companies (the deep pocket) supplying drugs and equipment to the anesthesia profession. The cost of malpractice insurance rose steeply as huge awards were paid to plaintiffs representing patients who had died during or soon after anesthesia or who had suffered permanent damage, often to the brain. Now the risks associated with anesthesia were widely discussed.

How safe is anesthesia?

The job of the anesthesiologist has often been compared to that of a pilot. In terms of safety, the pilots have it hands down. According to one government report,[3] "*a passenger who randomly chose a U.S. domestic jet flight between 1967 and 1976 would have a one in two million chance of dying. This death risk fell to one in seven million in the decades 1977–1986 and 1987–1996. Using data from 1990 to the present, the death risk falls to one in eight million.*" Compare that to the best statistics for anesthesia that list one death in 200 000 anesthetics. Of course, flying and undergoing anesthesia have little in common except that both are not entirely safe, that in both the victim does not contribute to a disaster, and that in both the passenger or patient has every right to expect that he or she will not be harmed by the trip – be it a flight or anesthetic.

How much money are we prepared to invest in safety?

The question is not easy to answer as we are looking at a spectrum ranging from inexpensive prophylactic vaccination with benefits that last years to acute interventions, as exemplified in the following story:

During the 1990s war in Bosnia, Captain Scott O'Grady, an American fighter pilot, was shot down over enemy territory. He survived the crash. The rescue operation to bring him back to safety involved two CH-53 E Sea Stallions (cost: $26 million apiece), two AH-1W Sea-Cobra gunships ($12.5 million apiece), four AV-8B Sea Harriers ($24 million apiece), F/A-18 fighter bombers ($30 million apiece), F-16s ($20 million apiece), F-15Es ($35 million apiece), EF-111s ($60 million), and AWACs ($250 million apiece). The investment of resources and funds to save one life was enormous and it was spectacularly successful. Afterward no one publicly suggested that to expend millions of dollars and risk many millions more to rescue Captain O'Grady was fiscally irresponsible, even though it was impossible to predict whether the effort would be successful.

Contrast that with the efforts to make anesthesia safe. Hospital administrators are likely to reckon the cost of investing in measures designed to enhance safety and then bemoan the fact that their balance sheet does not show good fiscal return for their investment.

Human error and the system

Whether we look at train wrecks, atomic energy catastrophes, shipping collisions, air traffic disasters, automobile crashes or anesthesia accidents, overwhelmingly human errors rather than mechanical failures are responsible for the calamity. In the olden days a single physician took care of a patient. If he (it was usually a "he" in those days) made an error, it was his error alone. The evolution of medicine has replaced that lone physician with today's healthcare team comprising many physicians (often working a shift schedule) with narrow but highly specialized skills working with uncounted nurses, technicians, and assistants caring for thousands of patients.

Paracelsus, a 16th-century physician, said of medicine: "Does not a lover go far to see a beautiful woman? How much further for a beautiful art?" Contrast that with the terminology heard all too often, particularly from hospital administrators, using the vernacular of manufacturers: We have a healthcare *industry* in which healthcare *providers* sell *services* to healthcare *consumers*. Gone is the image of a beautiful art. Instead we sense in the ugly phrases an industry and the hum (and intermittent squeaks) of a factory.

Over the clanking of the engines in the healthcare industry we hear ever-louder calls for lower cost AND increased safety and a higher quality of care. "Quality" measures not only safety, but also the cost, effectiveness, efficiency, and equitableness of care rendered. In light of increasing costs and limited resources we strive to provide the greatest value (= quality/cost) to our patients. To this end we adopt clinical care pathways, treatment guidelines, care bundles, and standards of care, all formulated from evidence-based medicine. Now pervasive protocols, procedure manuals, and checklists encourage us to adhere to management prescriptions rather than rely on judgments based on narrow personal experience and memory. Ideally, broad adoption of evidence-based guidelines will minimize deviations from "best practice" care and, when applied over a population, will improve overall outcomes. Detractors argue prescribed regimens fail to consider the uniqueness of each patient, potentially compromising the care of some. Therein lies the kernel for disagreement between advocates of policies promoting regulated versus individualized care. "Practice to achieve best outcomes" presents the more modern view. Physicians or centers that exceed defined quality of care benchmarks present a valuable resource to define "best practices" for adoption by those struggling to achieve the same benchmark.

Complications

The sizeable efforts to reduce errors and accidents and promote safety and quality have resulted in a multi-layered and complex system of modern medical care. Despite this, complications still occur (although with substantially reduced frequency). As in the past, most complications have multi-factorial roots. For example: A fatigued physician at the end of a 24-hour shift writes an order for a potent narcotic drug, eg., morphine sulfate. She intends 2.0 mg for the dose, but the decimal is buried in the number. She fails to write an order specifying when she wants to be called in case of problems. A junior pharmacist, uncertain of the drug's potency, sees a hint of a decimal point on the fax, but knows it is improper to use a decimal point followed by a zero (for this very reason) and therefore fills the prescription for 20 mg. A student nurse questions her supervisor about the dose. The supervisor checks the prescription and says: "if that's what the doctor ordered, we give it. She must have had a good reason to use such a large dose." The drug is administered. The patient falls asleep and a concerned visitor calls the nurse to check on the patient when the pulse oximeter sounds an alarm. The nurse administers oxygen, which improves the saturation but she fails to alert a physician. Oxygen pinks the patient's skin but does nothing to reverse the respiratory depression. The CO_2 continues to rise until it causes a respiratory arrest. It takes another minute for the oximeter to chime in again, by which time the accumulated CO_2 has caused an acidosis and hypertension so severe that the patient's heart stops. By the time anyone can respond to the alarm, evaluate the patient, call a code, and collect the equipment to institute mask–ventilation and start cardiopulmonary resuscitation, the patient has become another casualty of poor care.

As soon as possible after the event we start a "root cause analysis" in which every link in the system is examined. Several flaws are identified:

The physician made two mistakes: one of **co**mmission – using a trailing decimal point (medication errors are most common among the causes of medical disasters); the other of **o**mission – failing to identify thresholds for action. The system (i.e., administrators and service chiefs) had accepted a staffing pattern that caused a physician to work without the necessary breaks. The "system" often allows fiscal more than safety considerations to drive staffing decisions.

The pharmacist, uncertain about the prescribed dosage, dispensed the drug instead of checking on recommended dosages – a matter of protocols and education.

The student nurse was the next safety net. She almost succeeded in preventing the death. However, her supervisor, a senior nurse trained overseas in a hierarchical culture, was not prepared to challenge a physician's order. This failure can be attributed to the all too common hurdles of communicating between specialties and ranks of seniority. In the medical pecking order a cleaning woman is unlikely to call out when she sees the professor making a mistake. And yet, that's exactly what the patient, whose life was at stake, would expect her to do and the professor to appreciate. Every member of the system must feel personally responsible for the patient's safety.

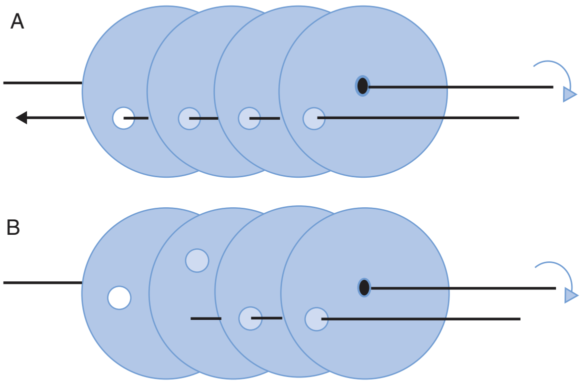

Fig. 1 Safety is sought by interposing layers of defenses. The first disk represents the physician erring in writing a prescription, the second the pharmacist, the third the student nurse, and the last the nurse administering oxygen without recognizing respiratory depression. The holes in these spinning disks have to be superimposed to allow the initial error to ripple through the system (A). Many more holes per disk and many more disks are required to represent the complexity of modern medical care. In B the disks have spun so that the propagation of the error has been stopped.

A nurse was called because the patient's oxygen saturation had dropped. Had she recognized this as an indication of hypoventilation, she could have called for help and avoided the disaster. Instead, she treated a symptom without correcting the problem. Adherence to a protocol spelling out the conditions that call for consultation would have prevented the problem, as would have appreciation of the ongoing pathophysiology.

The metaphor of slices of Swiss cheese or spinning disks has been used to illustrate that many serious complications in anesthesia, and medicine in general, have multiple roots. The holes in the disks line up so that an arrow (an error) can pass through (Fig. 1A). But when the wheels are spinning it takes a bit of bad luck to have the holes superimpose long enough for an error to sneak through (Fig. 1B).

Each error raises the question of what went wrong. When identifying the "holes in the disks" and linking it to a human error we are discouraged from pouncing on a wrongdoer. By focusing on the single culprit we can fail to deal with "upstream" errors, for example staffing decisions. Fear of punishment can inhibit the reporting of errors that must be identified before they cause harm.

The World Health Organization (WHO) has published a Surgical Safety Checklist. It establishes protocols designed to prevent the occasional, but recurring errors that have led to harm. The Safety Checklist applies from the time before induction of anesthesia (sign in), through just before skin incision (time-out, i.e., a momentary halt of all activities) and on to the time before the patient leaves the operating room (sign out). Table 1 shows, slightly modified, the WHO document. Importantly, the protocol involves in most instances the entire team. Safety depends on teamwork. An alert team has a better chance of blocking the propagation of an error than the individual, isolated practitioner (see the spinning disk metaphor). To paraphrase Atul Gawande[4]: with the knowledge to do things properly comes the responsibility to do so and do so reliably. Using checklists provides an efficient and effective means to increase reliability and safety (Table 1).

Safety in anesthesia

Safety concerns start long before induction and extend well after anesthesia wears off. In the operating room we often marvel at the wonderful (in the literal sense of the word) workings of the human body. As best we can, we describe the system by assessing parameters we might call indicators of health (see Chapter 7 on monitoring). We put thresholds around these parameters and cause our instruments to sound alarms when these thresholds are violated. Safety for our patients during anesthesia is achieved if we can manage to keep these parameters within the desired limits in the face of an onslaught of perturbations, be they a disease process, the effect of anesthetic drugs, mechanical ventilation, the surgical intervention, or changes in the patient's fluid status or temperature.

Many of the parameters we monitor have been elevated by national professional organizations to "minimal monitoring standards," even though we lack scientific proof of their efficacy. The Federal Aviation Administration does no less. It also issues rules that are based on analysis by experts rather than experimental proof.

An ancient Greek may have viewed someone undergoing a modern anesthetic as being escorted by Hypnos (the god of sleep) down to the river of Lethe (for forgetfulness and oblivion). And nearby, perhaps only briefly, enjoying the blooming poppy fields of Morpheus, the god of dreams (and Hypnos's son), before comfortably re-awakening. But we can never deliver anesthesia with the guaranteed safe outcomes such divine guidance would assure. So we embrace all the devices and strategies that help us conduct a safe anesthetic. Safety is not, however, simply a measure of

Table 1: The World Health Organization Surgical Safety Checklist (slightly modified)

Sign in	Pre-incision time-out	Sign out
Confirm: The patient's identity Site of operation Procedure Consent given by patient	Confirm that all team members have introduced themselves by name and role	The nurse verbally confirms with the team: The name of the procedure recorded in the record That instrument, sponge, and needle counts are correct (or not applicable) How the specimen is labeled (including the patient's name) Whether there are any equipment problems to be addressed
Site marked if applicable	Surgeon, anesthesia professionals, and nurse verbally confirm: Patient identity Operative site Planned procedure	Surgeon, anesthesia professional, and nurse review the key concerns for the recovery and management of the patient
Anesthesia Safety Check completed	Is the patient's current and – if appropriate – old medical record available?	
Pulse oximeter applied and working	Anticipate critical events Surgeon reviews: What are the: critical or unexpected steps, operative duration, anticipated blood loss? Anesthesia team reviews: What are patient-specific concerns? Nursing team reviews: Has sterility (including indicator results) been confirmed? Are there equipment issues or other concerns?	
Does the patient have a: Known allergy? Yes No Difficult airway or risk of aspiration? No Yes, and is equipment and assistance available? Risk of more than 500 mL blood loss (7 mL/kg in children)? No Yes, and adequate intravenous access and fluids planned?	Has antibiotic prophylaxis been given within the last 60 minutes? Yes Not applicable	

how much data or how many monitors are available to the clinician. Safety begins with a caring physician who is knowledgeable about her patient's conditions and their anesthetic implications. Because we are all fallible (remember "to err is human"), redundant safety features provide added protection. This redundancy is familiar to all who give anesthesia; we simultaneously use pulse oximetry, an oxygen delivery sensor, and breathed gas oxygen analysis. Similar redundancy occurs with heart function (ECG, pulse oximetric plethysmography, capnometry, and precordial or esophageal stethoscope). We equally depend on those around us; a nurse who will remind about redosing antibiotics or a surgeon who notifies "anesthesia" about unexpected bleeding. Protocols and checkpoints help insure that steps critical for the delivery of a safe anesthetic are not overlooked.

Our very own APSF has become the model for safety foundations in other countries and for national (not limited to anesthesia) safety foundations. Safety and quality are a joint effort across the spectrum of healthcare providers and deserve to remain in the forefront. There is much opportunity for improvement.

In the chapters that follow it will quickly become apparent (and repetitively so) that the *why* for virtually everything we do is to minimize risk and improve safety for our patients.

Notes

1 This ground-breaking IOM report, "To Err is Human," was followed two years later by "Crossing the Quality Chasm." These reports focused attention on issues of healthcare quality defining six aims – care should be safe, effective, patient-centered, timely, efficient, and equitable. The redesign of healthcare delivery continues with numerous initiatives and increasing regulation at every level. Subsequent outcome data will certainly be scrutinized as we all focus on quality and safety in medicine.

2 The distinction between standards and guidelines warrants mention. Both come from a medical society, for anesthesiologists this is the ASA (American Society of Anesthesiologists), but differ in their weight: standards define rules or minimum requirements, which should be followed except in extreme circumstances; guidelines present expert recommendations and are modified over time; for completeness, Statements may be released representing opinions and best medical judgments of the society, but these lack the formal scientific review of Standards and Guidelines. Attorneys may refer to all three.

3 www.anest.ufl.edu/ea.

4 Atul Gawande, a surgeon and writer, and Director of the WHO's Global Challenge for Safer Surgical Care, as of this writing has researched and written extensively on safety. The interested reader, and we sincerely hope it is nearly all, will benefit greatly from his books which currently include: *Complications*, *Better*, and *The Checklist Manifesto*.

Section 1 Clinical management

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Chapter 1

Pre-operative evaluation

Surgery and anesthesia cause major perturbations to a patient's homeostasis. The risk of potentially life-threatening complications can be reduced with appropriate pre-operative evaluation and therapy. For those patients admitted prior to surgery, we take the opportunity to meet and evaluate them the evening before their operation. Because cost concerns have virtually eliminated pre-operative hospital admission, today the visit may occur just moments before the operation in the case of an emergency or a healthy outpatient, but is better managed in pre-anesthesia clinics to which patients report one or several days before their operation. Surgeons and primary-care physicians can do much to avoid operative delays and cancellations, as well as to reduce the patient's cost and risk by identifying patients who need a pre-operative anesthesia consultation and by sending all pertinent information, e.g., recent ECG, echocardiography and stress study reports, etc., with the patient. The pre-anesthetic evaluation appears to be just another routine of eliciting a history, reviewing all systems, performing a physical examination, and checking laboratory studies. However, this traditional approach provides the structure that enables us to ferret out information that can affect anesthetic preparation and management. A widely accepted shorthand, the famous ASA Physical Status classification (Table 1.1), summarizes a thorough patient evaluation into a simple scheme, found on every anesthesia record. In fact assigning an ASA Physical Status classification is an expected standard of care component of every pre-anesthetic evaluation by an anesthesia provider. The six Physical Status classes do *not* address risk specifically, but do provide a common nomenclature when discussing patients in general. That much more than the ASA Physical Status classification need be known will become apparent from the following.

History

We begin with the "H" in "H&P," obtaining a medical and surgical history. We are particularly concerned with the cardiopulmonary system, and exercise tolerance is a very good measure of current status. We also search for evidence of chronic diseases of other systems. For elective procedures, patients should be in the best condition possible, e.g., no exacerbation of chronic bronchitis or unstable angina. Below, we describe the pre-operative evaluation of some common medical conditions. When patients with these, or other rarer, conditions require an anesthetic, a pre-anesthesia clinic visit a week or so in advance of anesthesia allows time to seek additional information such as study results from the patient's private physician, perform studies such as cardiac pacemaker interrogation, or obtain consultation from a specialist. Such planning helps keep the operating schedule running smoothly.

We inquire about any previous anesthetics, particularly any untoward events such as bleeding or airway management difficulties. It is reassuring to learn a patient has tolerated previous anesthetics without complications or symptoms of a challenging airway (e.g., severe sore throat, chipped tooth). Next, we ask specifically about any family history of anesthetic complications. A patient might not realize that a remote event, such as his Aunt Edna dying with a raging fever soon after an anesthetic many years ago, might mean that malignant hyperthermia runs in his family. We need to ask specific questions to learn about inherited conditions, including those related to plasma cholinesterase (see discussion of succinylcholine in Chapter 12).

Medications

With surprising frequency, review of the patient's current medications reveals previously unmentioned medical problems: "Oh, the atenolol? Well I don't have high blood pressure *now*." Many medications influence the anesthetic, particularly those with cardiovascular or coagulation-related effects. Some need to be discontinued for some period prior to surgery (see below); others must be converted from oral to parenteral form