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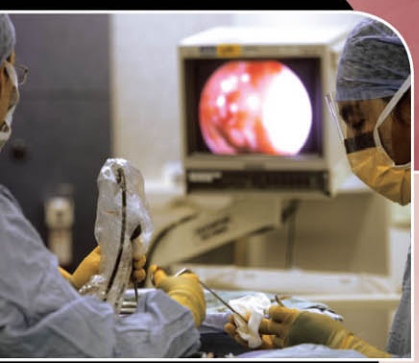
CURRENT Diagnosis & Treatment



Surgery

GERARD M. DOHERTY

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FOURTEENTH EDITION

Edited by

Gerard M. Doherty, MD
James Utley Professor of Surgery and Chair,
Department of Surgery
Boston University School of Medicine
Surgeon-in-Chief, Boston Medical Center
Boston, Massachusetts

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Approach to the Surgical Patient

1

J. Englebert Dunphy, MD*
Lawrence W. Way, MD

The management of surgical disorders requires not only the application of technical skills and training in the basic sciences to the problems of diagnosis and treatment but also a genuine sympathy and indeed love for the patient. The surgeon must be a doctor in the old-fashioned sense, an applied scientist, an engineer, an artist, and a minister to his or her fellow human beings. Because life or death often depends upon the validity of surgical decisions, the surgeon's judgment must be matched by courage in action and by a high degree of technical proficiency.

THE HISTORY

At their first contact, the surgeon must gain the patient's confidence and convey the assurance that help is available and will be provided. The surgeon must demonstrate concern for the patient as a person who needs help and not just as a "case" to be processed. This is not always easy to do, and there are no rules of conduct except to be gentle and considerate. Most patients are eager to like and trust their doctors and respond gratefully to a sympathetic and understanding person. Some surgeons are able to establish a confident relationship with the first few words of greeting; others can only do so by means of a stylized and carefully acquired bedside manner. It does not matter how it is done, so long as an atmosphere of sympathy, personal interest, and understanding is created. Even under emergency circumstances, this subtle message of sympathetic concern must be conveyed.

Eventually, all histories must be formally structured, but much can be learned by letting the patient ramble a little. Discrepancies and omissions in the history are often due as much to overstructuring and leading questions as to the unreliability of the patient. The enthusiastic novice asks leading questions; the cooperative patient gives the answer that seems to be wanted; and the interview concludes on a note of mutual satisfaction with the wrong answer thus developed.

BUILDING THE HISTORY

History taking is detective work. Preconceived ideas, snap judgments, and hasty conclusions have no place in this process. The diagnosis must be established by inductive reasoning. The interviewer must first determine the facts and then search for essential clues, realizing that the patient may conceal the most important symptom—for example, the passage of blood by rectum—in the hope (born of fear) that if it is not specifically inquired about or if nothing is found to account for it in the physical examination, it cannot be very serious.

Common symptoms of surgical conditions that require special emphasis in the history taking are discussed in the following paragraphs.

Pain

A careful analysis of the nature of pain is one of the most important features of a surgical history. The examiner must first ascertain how the pain began. Was it explosive in onset, rapid, or gradual? What is the precise character of the pain? Is it so severe that it cannot be relieved by medication? Is it constant or intermittent? Are there classic associations, such as the rhythmic pattern of small bowel obstruction or the onset of pain preceding the limp of intermittent claudication?

One of the most important aspects of pain is the patient's reaction to it. The overreactor's description of pain is often obviously inappropriate, and so is a description of "excruciating" pain offered in a casual or jovial manner. A patient who shrieks and thrashes about is either grossly overreacting or suffering from renal or biliary colic. Very severe pain—due to infection, inflammation, or vascular disease—usually forces the patient to restrict all movement as much as possible.

*Deceased

Moderate pain is made agonizing by fear and anxiety. Reassurance of a sort calculated to restore the patient's confidence in the care being given is often a more effective analgesic than an injection of morphine.

Vomiting

What did the patient vomit? How much? How often? What did the vomitus look like? Was vomiting projectile? It is especially helpful for the examiner to see the vomitus.

Change in Bowel Habits

A change in bowel habits is a common complaint that is often of no significance. However, when a person who has always had regular evacuations notices a distinct change, particularly toward intermittent alternations of constipation and diarrhea; colon cancer must be suspected. Too much emphasis is placed upon the size and shape of the stool—for example, many patients who normally have well-formed stools may complain of irregular small stools when their routine is disturbed by travel or a change in diet.

Hematemesis or Hematochezia

Bleeding from any orifice demands the most critical analysis and can never be dismissed as due to some immediately obvious cause. The most common error is to assume that bleeding from the rectum is attributable to hemorrhoids. The character of the blood can be of great significance. Does it clot? Is it bright or dark red? Is it changed in any way, as in the coffee-ground vomitus of slow gastric bleeding or the dark, tarry stool of upper gastrointestinal bleeding? The full details and variations cannot be included here but will be emphasized under separate headings elsewhere.

Trauma

Trauma occurs so commonly that it is often difficult to establish a relationship between the chief complaint and an episode of trauma. Children in particular are subject to all kinds of minor trauma, and the family may attribute the onset of an illness to a specific recent injury. On the other hand, children may be subjected to severe trauma though their parents are unaware of it. The possibility of trauma having been inflicted by a parent must not be overlooked.

When there is a history of trauma, the details must be established as precisely as possible. What was the patient's position when the accident occurred? Was consciousness lost? Retrograde amnesia (inability to remember events just preceding the accident) always indicates some degree of cerebral damage. If a patient can remember every detail of an accident, has not lost consciousness, and has no evidence of external injury to the head, brain damage can be excluded.

In the case of gunshot wounds and stab wounds, knowing the nature of the weapon, its size and shape, the probable trajectory, and the position of the patient when hit may be very helpful in evaluating the nature of the resultant injury.

The possibility that an accident might have been caused by preexisting disease such as epilepsy, diabetes, coronary artery disease, or hypoglycemia must be explored.

When all of the facts and essential clues have been gathered, the examiner is in a position to complete the study of the present illness. By this time, it may be possible to rule out (by inductive reasoning) all but a few diagnoses. A novice diagnostician asked to evaluate the causes of shoulder pain in a given patient might include ruptured ectopic pregnancy in the list of possibilities. The experienced physician will automatically exclude that possibility on the basis of gender or age.

Family History

The family history is of great significance in a number of surgical conditions. Polyposis of the colon is a classic example, but diabetes, Peutz-Jeghers syndrome, chronic pancreatitis, multiglandular syndromes, other endocrine abnormalities, and cancer are often better understood and better evaluated in the light of a careful family history.

Past History

The details of the past history may illuminate obscure areas of the present illness. It has been said that people who are well are almost never sick, and people who are sick are almost never well. It is true that a patient with a long and complicated history of diseases and injuries is likely to be a much poorer risk than even a very old patient experiencing a major surgical illness for the first time.

In order to make certain that important details of the past history will not be overlooked, the system review must be formalized and thorough. By always reviewing the past history in the same way, the experienced examiner never omits significant details. Many skilled examiners find it easy to review the past history by inquiring about each system as they perform the physical examination on that part of the body.

In reviewing the past history, it is important to consider the nutritional background of the patient. There is a clear awareness throughout the world that the underprivileged malnourished patient responds poorly to disease, injury, and operation. Malnourishment may not be obvious on physical examination and must be elicited by questioning.

Acute nutritional deficiencies, particularly fluid and electrolyte losses, can be understood only in the light of the total (including nutritional) history. For example, low serum sodium may be due to the use of diuretics or a sodium-restricted diet rather than to acute loss. In this connection, the use of any medications must be carefully recorded and interpreted.

A detailed history of acute losses by vomiting and diarrhea—and the nature of the losses—is helpful in estimating the probable trends in serum electrolytes. Thus, the patient who has been vomiting persistently with no evidence of bile in the vomitus is likely to have acute pyloric stenosis associated with benign ulcer, and hypochloremic alkalosis must be anticipated. Chronic vomiting without bile—and particularly with evidence of changed and previously digested food—is suggestive of chronic obstruction, and the possibility of carcinoma should be considered.

It is essential for the surgeon to think in terms of nutritional balance. It is often possible to begin therapy before the results of laboratory tests have been obtained, because the specific nature and probable extent of fluid and electrolyte losses can often be estimated on the basis of the history and the physician's clinical experience. Laboratory data should be obtained as soon as possible, but knowledge of the probable level of the obstruction and of the concentration of the electrolytes in the gastrointestinal fluids will provide sufficient grounds for the institution of appropriate immediate therapy.

The Patient's Emotional Background

Psychiatric consultation is seldom required in the management of surgical patients, but there are times when it is of great help. Emotionally and mentally disturbed patients require surgical operations as often as others, and full cooperation between psychiatrist and surgeon is essential. Furthermore, either before or after an operation, a patient may develop a major psychotic disturbance that is beyond the ability of the surgeon to appraise or manage. Prognosis, drug therapy, and overall management require the participation of a psychiatrist.

On the other hand, there are many situations in which the surgeon can and should deal with the emotional aspects of the patient's illness rather than resorting to psychiatric assistance. Most psychiatrists prefer not to be brought in to deal with minor anxiety states. As long as the surgeon accepts the responsibility for the care of the whole patient, such services are superfluous.

This is particularly true in the care of patients with malignant disease or those who must undergo mutilating operations such as amputation of an extremity, ileostomy, or colostomy. In these situations, the patient can be supported far more effectively by the surgeon and the surgical team than by a consulting psychiatrist.

Surgeons are increasingly aware of the importance of psychosocial factors in surgical convalescence. Recovery from a major operation is greatly enhanced if the patient is not worn down with worry about emotional, social, and economic problems that have nothing to do with the illness itself. Incorporation of these factors into the record contributes to better total care of the surgical patient.

THE PHYSICAL EXAMINATION

The complete examination of the surgical patient includes the physical examination, certain special procedures such as gastroscopy and esophagoscopy, laboratory tests, x-ray examination, and follow-up examination. In some cases, all of these may be necessary; in others, special examinations and laboratory tests can be kept to a minimum. It is just as poor practice to insist on unnecessary thoroughness as it is to overlook procedures that may contribute to the diagnosis. Painful, inconvenient, and costly procedures should not be ordered unless there is a reasonable chance that the information gained will be useful in making clinical decisions.

THE ELECTIVE PHYSICAL EXAMINATION

The elective physical examination should be done in an orderly and detailed fashion. One should acquire the habit of performing a complete examination in exactly the same sequence, so that no step is omitted. When the routine must be modified, as in an emergency, the examiner recalls without conscious effort what must be done to complete the examination later. The regular performance of complete examinations has the added advantage of familiarizing the beginner with what is normal so that what is abnormal can be more readily recognized.

All patients are sensitive and somewhat embarrassed at being examined. It is both courteous and clinically useful to put the patient at ease. The examining room and table should be comfortable, and drapes should be used if the patient is required to strip for the examination. Most patients will relax if they are allowed to talk a bit during the examination, which is another reason for taking the past history while the examination is being done.

A useful rule is to first observe the patient's general physique and habitus and then to carefully inspect the hands. Many systemic diseases show themselves in the hands (cirrhosis of the liver, hyperthyroidism, Raynaud disease, pulmonary insufficiency, heart disease, and nutritional disorders).

Details of the examination cannot be included here. The beginner is urged to consult special texts.

Inspection, palpation, and auscultation are the time-honored essential steps in appraising both the normal and the abnormal. Comparison of the two sides of the body often suggests a specific abnormality. The slight droop of one eyelid characteristic of Horner syndrome can only be recognized by comparison with the opposite side. Inspection of the female breasts, particularly as the patient raises and lowers her arms, will often reveal slight dimpling indicative of an infiltrating carcinoma barely detectable on palpation.

Successful palpation requires skill and gentleness. Spasm, tension, and anxiety caused by painful examination procedures may make an adequate examination almost impossible, particularly in children.

Another important feature of palpation is the laying on of hands that has been called part of the ministry of medicine. A disappointed and critical patient often will say of a doctor, "He hardly touched me." Careful, precise, and gentle palpation not only gives the physician the information being sought but also inspires confidence and trust.

When examining for areas of tenderness, it may be necessary to use only one finger in order to precisely localize the extent of the tenderness. This is of particular importance in examination of the acute abdomen.

Auscultation, once thought to be the exclusive province of the physician, is now more important in surgery than it is in medicine. Radiologic examinations, including cardiac catheterization, have relegated auscultation of the heart and lungs to the status of preliminary scanning procedures in medicine. In surgery, however, auscultation of the abdomen and peripheral vessels has become absolutely essential. The nature of ileus and the presence of a variety of vascular lesions are revealed by auscultation. Bizarre abdominal pain in a young woman can easily be ascribed to hysteria or anxiety on the basis of a negative physical examination and x-rays of the gastrointestinal tract. Auscultation of the epigastrium, however, may reveal a murmur due to obstruction of the celiac artery.

Examination of the Body Orifices

Complete examination of the ears, mouth, rectum, and pelvis is accepted as part of a complete examination. Palpation of the mouth and tongue is as essential as inspection. Every surgeon should acquire familiarity with the use of the ophthalmoscope and sigmoidoscope and should use them regularly in doing complete physical examinations.

THE EMERGENCY PHYSICAL EXAMINATION

In an emergency, the routine of the physical examination must be altered to fit the circumstances. The history may be limited to a single sentence, or there may be no history if the patient is unconscious and there are no other informants. Although the details of an accident or injury may be very useful in the total appraisal of the patient, they must be left for later consideration. The primary considerations are the following: Is the patient breathing? Is the airway open? Is there a palpable pulse? Is the heart beating? Is massive bleeding occurring?

If the patient is not breathing, airway obstruction must be ruled out by thrusting the fingers into the mouth and pulling the tongue forward. If the patient is unconscious, the respiratory tract should be intubated and mouth-to-mouth respiration started. If there is no pulse or heartbeat, start cardiac resuscitation.

Serious external loss of blood from an extremity can be controlled by elevation and pressure. Tourniquets are rarely required.

Every victim of major blunt trauma should be suspected of having a vertebral injury capable of causing damage to the spinal cord unless rough handling is avoided.

Some injuries are so life threatening that action must be taken before even a limited physical examination is done. Penetrating wounds of the heart, large open sucking wounds of the chest, massive crush injuries with flail chest, and massive external bleeding all require emergency treatment before any further examination can be done.

In most emergencies, however, after it has been established that the airway is open, the heart is beating, and there is no massive external hemorrhage—and after antishock measures have been instituted, if necessary—a rapid survey examination must be done. Failure to perform such an examination can lead to serious mistakes in the care of the patient. It takes no more than 2 or 3 minutes to carefully examine the head, thorax, abdomen, extremities, genitalia (particularly in females), and back. If cervical cord damage has been ruled out, it is essential to turn the injured patient and carefully inspect the back, buttocks, and perineum.

Tension pneumothorax and cardiac tamponade may easily be overlooked if there are multiple injuries.

Upon completion of the survey examination, control of pain, splinting of fractured limbs, suturing of lacerations, and other types of emergency treatment can be started.

LABORATORY & OTHER EXAMINATIONS

Laboratory Examination

Laboratory examinations in surgical patients have the following objectives:

1. Screening for asymptomatic disease that may affect the surgical result (eg, unsuspected anemia or diabetes)
2. Appraisal of diseases that may contraindicate elective surgery or require treatment before surgery (eg, diabetes, heart failure)
3. Diagnosis of disorders that require surgery (eg, hyperparathyroidism, pheochromocytoma)
4. Evaluation of the nature and extent of metabolic or septic complications

Patients undergoing major surgery, even though they seem to be in excellent health except for their surgical disease, should have age-appropriate laboratory examination. A history of renal, hepatic, or heart disease requires detailed studies. Medical consultation may be helpful in the total preoperative appraisal of the surgical patient. It is essential, however, that the surgeon not become totally dependent upon a medical consultant for the preoperative evaluation and management of the patient. The total management must be the surgeon's responsibility and is not to be delegated. Moreover, the surgeon is the only one with the experience

and background to interpret the meaning of laboratory tests in the light of other features of the case—particularly the history and physical findings.

Imaging Studies

Modern patient care calls for a variety of critical radiologic examinations. The closest cooperation between the radiologist and the surgeon is essential if serious mistakes are to be avoided. This means that the surgeon must not refer the patient to the radiologist, requesting a particular examination, without providing an adequate account of the history and physical findings. Particularly in emergency situations, review of the films and consultation are needed.

When the radiologic diagnosis is not definitive, the examinations must be repeated in the light of the history and physical examination. Despite the great accuracy of x-ray diagnosis, a negative gastrointestinal study still does not exclude either ulcer or a neoplasm; particularly in the right colon, small lesions are easily overlooked. At times, the history and physical findings are so clearly diagnostic that operation is justifiable despite negative imaging studies.

Special Examinations

Special examinations such as cystoscopy, gastroscopy, esophagoscopy, colonoscopy, angiography, and bronchoscopy are often required in the diagnostic appraisal of surgical disorders. The surgeon must be familiar with the indications and limitations of these procedures and be prepared to consult with colleagues in medicine and the surgical specialties as required.

2 Training, Communication, Professionalism, & Systems-Based Practice

Gerard M. Doherty, MD

TRAINING

The process of medical education and surgical training in the United States is overseen by an interconnected group of organizations. Each of these organizations has their specific focus; however, the common theme is continuous process improvement encouraged by intermittent external review (Table 2–1). The ultimate goal is the provision of a consistent, qualified, and professional workforce for medical care in the United States.

Medical Student Education

The Liaison Committee on Medical Education (LCME) is the group that provides accreditation for medical schools in the United States and Canada. *Accreditation* is the process of quality assurance in postsecondary education that assesses whether an institution meets established standards. Accreditation by the LCME is effectively necessary for schools to function in the United States. Without accreditation, the schools cannot receive federal grants for medical education or participate in federal loan programs. Graduation from an LCME-accredited school enables students to sit for medical licensing examinations (the USMLE) and to achieve licensure in most states around the country. Graduation from an LCME-accredited medical school is also necessary for acceptance into an ACGME-accredited residency program (see below) for graduates of US medical schools. The authority for the LCME to provide this accreditation is delegated by the United States Department of Education in the United States and the Committee on Accreditation of Canadian Medical Schools (CACMS) in Canada.

Each accredited medical school is reviewed annually for appropriateness of their function, structure, and performance. Formal site visits are conducted periodically with more in-depth review and reaccreditation at that time. The usual period of full accreditation is 8 years. At the time of this in-depth accreditation visit, and in the intervals between, the LCME works to disseminate best practices and approve the overall quality of education leading to the MD degree.

Graduate Medical Education

The Accreditation Council for Graduate Medical Education (ACGME) is responsible for the accreditation of post MD medical training programs within the United States. Accreditation is accomplished through a peer review process based on established standards and guidelines. The member organizations of the ACGME as an accrediting group are the American Board of Medical Specialties (ABMS), the American Hospital Association (AHA), the American Medical Association (AMA), the Association of American Medical Colleges (AAMC), and the Council of Medical Specialty Societies. The ACGME oversees a variety of graduate medical education programs in specific specialties. These ACGME-accredited residency programs must adhere to the ACGME common program requirements that apply to all residencies, as well as specific program requirements that apply to each training program. The ACGME also accredits institutions to house the residency training programs. There are thus also institutional requirements that must be met for overall accreditation of the institution to house training programs.

The ACGME has identified six general competency areas that must be addressed during every graduate residency training program (Table 2–2). The specific application of these competency areas varies widely among training programs. However, each rotation of each residency must include attention to, and assessment of, progress in fulfilling the general competency requirements.

The review and accreditation of specialty residency programs is undertaken by a committee specific for that field. In surgery, the group is the Residency Review Committee

Table 2–1. US organizations with medical education oversight.

Organization	Acronym and Website	Purpose
Liaison Committee on Medical Education	LCME www.LCME.org	Accreditation of medical schools in the United States and Canada
Accreditation Council for Graduate Medical Education	ACGME www.ACGME.org	Accreditation of post-MD training programs in some specialties
American Board of Surgery	ABS www.absurgery.org	Certifies and recertifies individual surgeons who have met standards of education, training, and knowledge
American College of Surgeons	ACS www.facs.org	Scientific and educational association of surgeons to improve the quality of care for the surgical patient

for Surgery (RRC-S). The RRC-S assesses program compliance with accreditation standards both at the common program requirement level, and at the program specific level. Programs are typically fully accredited on a five year cycle, with annual updates and questionnaires in the interim. Early site visits can be triggered by a variety of events including significant changes in the program or its leadership. The Residency Review Committees also control the number of positions that each program is accredited to have. This effectively sets the maximum number of graduates that can finish from a given training program in any given year.

American Board of Surgery

The American Board of Surgery (ABS) is an independent, nonprofit organization with the purpose of certifying individual surgeons who have met defined standards of education, training, and knowledge. The distinction between the ACGME and the ABS is that the ACGME accredits training programs, while the ABS certifies individuals. This distinction is similar for specialty boards in other disciplines as well. The ABS also recertifies practicing surgeons, and is making a fundamental philosophical change from periodic retesting for recertification to a more continuous maintenance of certification (MOC) plan.

The ACGME and the specialty boards interact. The success of individuals in achieving board certification is considered an important measure of graduate medical education program success, and the measures that can be required of an individual for board certification must somehow also reflect the education that is offered to them through their graduate medical education. Thus though these entities have different purposes, they must, optimally, mesh their efforts constructively.

Board certification within a defined period after completing residency is necessary for privileging to perform surgery in many hospitals in the United States. Thus the most straightforward route into surgical practice in the United States includes graduation from an LCME-accredited medical school, completion of an ACGME-accredited residency training program, and satisfactory completion of the Qualifying Examination (written boards), and Certifying Examination (oral boards) of the American Board of Surgery.

There are other entry points into surgical practice in the United States, most prominently by physicians who have graduated from medical schools in countries outside the United States and Canada. These graduates can be certified by the Educational Commission for Foreign Medical Graduates (ECFMG). Once an individual graduate has been certified by the ECFMG, then he or she is eligible to train in an ACGME-approved residency training program, and can thus be eligible for board certification.

Table 2–2. ACGME general competencies for graduate medical education.

General Competency
• Patient care
• Medical knowledge
• Interpersonal and communication skills
• Professionalism
• Practice-based learning
• Systems-based practice

American College of Surgeons

The American College of Surgeons (ACS) is a scientific and educational association of surgeons whose mission is to improve the quality of care for the surgical patient by setting high standards for surgical education and practice. The ACS has members, known as fellows, who are entitled to use the letters FACS after their name. Membership as a fellow implies that the surgeon has met standards of education, training, professional qualifications, surgical competence, and ethical conduct. However, despite these requirements, the ACS is a voluntary professional membership group,

and does not certify individuals for practice. The ACS does sponsor a wide variety of educational and professional support programs both for practicing surgeons and trainees. In addition, they have membership categories for surgeons in training (Resident Membership) and students (Medical Student Membership), and for those surgeons who have completed training but have not yet met all the requirements for fellowship (Associate Fellow). The ACS also engages in important advocacy roles on behalf of patients and the surgeon members.

COMMUNICATION

Efficient and effective communication skills are a critical resource for all clinicians including surgeons. A surgeon must be capable of establishing a rapport with the patient and family quickly and reliably. This mutual respect is critical to a therapeutic relationship. The patient and family must be confident of the competence of the surgeon in order to participate in the recommended management and recovery. Judgments about surgeon competence frequently come within the first few moments of interaction based on the surgeon's ability to communicate. In addition to communicating with patients, clinicians must communicate with referring and collaborating physicians, and also within their own health care teams.

Communicating With Patients

Communication with patients requires attention to several aspects. First, the clinician must demonstrate respect for the patient as a person. Second, the clinician must display effective listening to the patient's message, followed by demonstrated empathy to their situation or concerns. Finally, the clinician must have clarity in the response. If any of these items are omitted, then the interaction will be less effective than it could be. Many surgeons try to jump straight to a very clear concise statement of the plan; however, unless the first three steps have occurred, the patient may not listen to the plan at all.

Respect

It is critically important to show respect for the patient and family as persons. The health care environment is often inconvenient and encountered during a time of stress. The patients are out of their normal venue and zone of comfort. They are often frightened by the prospect of what they may learn. Showing respect for their identity will place the patient at more ease and encourage their trusting communication with the clinician. Failing to show respect will have the contrary effect. Thus meeting an adult for the first time and addressing them by their first name can immediately put many patients on guard with respect to their personal independence and control. Similarly, referring to the mother of a pediatric patient as "Mom" rather than using her name implies lack of attention to her as an individual worthy of learning her identity. On initial meetings, the clinician should use the patient's last name preceded by an honorific title (Mr. Smith, or Ms. Jones). If you are not certain if a woman prefers Mrs. or Ms, then ask her. In contemporary US society, a woman over 18 years of age is never referred to as Miss.

In addition, engaging in brief small talk regarding some aspect of a patient's life other than the medical matter at hand can additionally put them at ease ("It must be interesting to be a dog trainer. What is your favorite breed?"). These efforts will be rewarded by a more trusting patient and a more efficient interview, with a better therapeutic relationship over the long term.

Listening

Listening to the patient is critical to establishing a correct diagnosis and appropriate therapeutic plan for the individual. Every patient who comes to the medical system with a problem has a story that they have thought through and decided to tell. It is important to let them do so. Not only is the patient likely to reveal critical issues regarding the clinical matter, but they are also often determined to tell the story eventually, whether they are allowed to do so at the outset or not. Allowing, and in fact encouraging them, to tell the story at the beginning of the interview relieves them of this burden of information, and allows the clinician to move on to interpretation.

Listening should be an active, engaged activity. The clinician should appear comfortable, settled, and upon as much of an even eye level with the patient as possible. It is important not to appear rushed, inattentive, or bored by their account. Interjecting questions for clarity or intermittent, brief verbal encouragements will let the patient know that the clinician is engaged with the problem.

It may be helpful at the outset of the listening phase to let the patient know what materials have been reviewed; for example, telling the patient that the clinician has reviewed the referral letter from the primary physician, the results of the last two operations, and their recent laboratory work may help the patient to be more concise in their discussion.

Empathy

Once the patient has recounted their history and the other aspects of examination and data review have been completed, it is important to review this material with the patient in a way that demonstrates empathy with their situation. A surgeon's understanding of the problem is important for the patient, but the problem is not confined to the medical issue, the problem must be understood in the context of the patient. For this reason demonstration of empathy is

important to the patient's trust of the physician. Establishing this connection with the patient is crucial to their engagement in the process of care.

Clarity

Having established respect for the patient, heard and understood their story, and empathized with their situation, the physician must speak clearly and in a vocabulary understood by the individual, about the recommendations for further evaluation or care. This portion of the conversation should include a clear distinction between what is known about the patient's diagnosis or condition and what is not known but might be anticipated. When appropriate, likelihoods of various outcomes should be estimated in a way that the patient can grasp. The recommended approach to next steps should be listed clearly, along with alternative approaches. Patients always have at least one alternative to the recommended choice, even if this is only to decide not to have further medical care. This portion of the conversation can be augmented with illustrations or models that may improve the patient's understanding. Often reviewing radiological studies directly with the patient or family at this time can help their understanding.

The risk taken by failing to establish this relationship with the patient is great. This can lead to errors in judgment about diagnosis or management. It also precludes the opportunity to engage the patient as an ally in his or her care. If things go badly, it also can make subsequent communication about problems or complications difficult or impossible. Finally, the surgeon who communicates poorly excludes him- or herself from enjoying a personally and professionally satisfying physician-patient relationship.

Communication With Collaborating Physicians

Surgeons often work with other physicians in collaboration of care for patients. Communication in these settings is important to the overall patient outcome, particularly when the surgeon will be involved in the patient's care for some defined interval which has been preceded and will be followed by the ongoing care provided by the primary care physician. The communication in these settings can be separated into two basic types: routine and urgent. Routine communication can take place in a variety of ways depending on the health care setting. This communication is typically asynchronous and written. It may take the form of a note in the patient's electronic medical record, or a letter sent to the physician's office. This is an appropriate way to communicate reasonably expected information that does not need to be acted on urgently. For example, a patient who is referred to a surgeon for cholecystectomy and who has a plan made for cholecystectomy can have routine communication back to the referring physician.

Urgent communication should occur to the collaborating physicians when there are unexpected or adverse outcomes. Again, there are a variety of communication modes that may be utilized for this, but the communication is more often synchronous via a direct conversation either in person or by telephone. The communication is more than courtesy to the collaborating physician, as knowledge of these events allows them to participate constructively on behalf of the patient. Examples of situations that warrant more urgent communication include new diagnosis of significant cancers, life-altering complications from interventions, and certainly death of the patient.

Clarity in transfer of care responsibility is critical to the continuous optimal care of the patient. For that reason, any communication with the collaborating physicians should indicate either the ongoing role of the surgeon in the patient's care, or the deliberate transfer of responsibility for ongoing care issues back to other collaborating physicians.

Communications Within Teams

Surgical care is often provided in a team setting. Current surgical teams typically include physicians, nonphysician mid-level providers (often physician assistants or nurse practitioners), and a variety of students. The student trainees may include students in medical school, physician assistant programs, or nursing school. These teams have become increasingly complex, and the information that they manipulate as a team to provide patient care is voluminous. In addition, the transfer of information from one provider to another as shifts or rotations change is recognized as a weak point in the patient care continuum.

With these complex teams and extensive information, the keys to efficient and effective team processes appear to be clarity of roles and designing processes that involve only writing things down once. The advent of electronic medical records has allowed the generation of electronic tools to transfer information from team member to team member. This may be useful to facilitate this process. Careful attention to transfers of care from one provider to another and explicit recognition that this is a potential time for errors is important.

PROFESSIONALISM

Professionalism denotes a series or group of behaviors that demonstrates that a person has achieved status as a professional. A *professional* in this context is implied to possess the specialized knowledge and have gone through long and intensive academic preparation for their vocation. These behaviors affect the interactions that professionals have both with patients and with other health care professionals. For optimal effectiveness, the surgeon should behave in a professional way both with patients and within their health

Table 2–3. AMA principles of medical ethics.

1. A physician shall be dedicated to providing competent medical care, with compassion and respect for human dignity and rights.
2. A physician shall uphold the standards of professionalism, be honest in all professional interactions, and strive to report physicians deficient in character or competence, or engaging in fraud or deception, to appropriate entities.
3. A physician shall respect the law and also recognize a responsibility to seek changes in those requirements which are contrary to the best interests of the patient.
4. A physician shall respect the rights of patients, colleagues, and other health professionals, and shall safeguard patient confidences and privacy within the constraints of the law.
5. A physician shall continue to study, apply, and advance scientific knowledge, maintain a commitment to medical education, make relevant information available to patients, colleagues, and the public, obtain consultation, and use the talents of other health professionals when indicated.
6. A physician shall, in the provision of appropriate patient care, except in emergencies, be free to choose whom to serve, with whom to associate, and the environment in which to provide medical care.
7. A physician shall recognize a responsibility to participate in activities contributing to the improvement of the community and the betterment of public health.
8. A physician shall, while caring for a patient, regard responsibility to the patient as paramount.
9. A physician shall support access to medical care for all people.

Available at http://www.ama-assn.org/ama/pub/category/2512.html

care institutions. The American Medical Association has promulgated a set of medical ethical principles that apply equally well to surgical practice, and that can help to guide professional behavior (Table 2–3).

The ethics of surgical practice are complex, and can be approached from a variety of theoretical frameworks. The most commonly applied framework for the evaluation of ethical dilemmas for individual patient decisions in medicine, known as "The Principles Approach," involves four principles: Autonomy, Beneficence, Nonmaleficence, and Justice, as promulgated by Beauchamp and Childress (Table 2–4). A detailed analysis of these principles is beyond the scope here; however, the need for a code of medical ethics that is distinct from general societal ethics is the basis for medical professionalism. The following are five features of medical relationships that provide the moral imperatives underlying the profession and the requirement for a separate ethical code from other forms of business.

1. The inequality in medical knowledge, and attendant vulnerability, of the patient
2. The requirement for the patient to trust the physician, known as the fiduciary nature of the relationship

Table 2–4. Principles of medical ethics: "The Principles Approach."

Principle	Definition
Autonomy	Deliberated self-rule; the patient has the right to choose or refuse their treatments; requires physicians to consult and obtain patient agreement before doing things to them
Beneficence	A practitioner should act in the best interest of the patient, without regard to physician's self-interest
Nonmaleficence	Do no harm; the practitioner should avoid treatments that harm the patient
Justice	Rendering what is due to others; affects the distribution of medical care among patients and populations

3. The moral nature of medical decisions that encompass both the technical aspects of health management and the ultimate effect on the patient's life
4. The nature of medical knowledge as a public property that physicians receive in order to apply to the practical improvement of patients' lives
5. The moral complicity of the physician in the outcome of the prescribed care, in that no formal medical care can take place without the physician's collusion

Because of these characteristics of the relationship between physicians and their patients, physicians must adhere to a set of ethical constraints specific to their profession.

While these imperatives are not generally understood explicitly by patients, patients can clearly grasp when these principles are in danger. They may even be suspicious that their physician or surgeon has competing motives to the patient's best interest. One of the goals of the physician-patient interaction is to allay these fears, and construct a trusting relationship based on the patient's needs, within the principles noted above.

Interaction With Patients

The interactions with patients should be characterized by polite and possibly somewhat formal manners. These manners will aid the professional in their communication efforts as noted above. In order to meet the patient's expectations of what the physician or surgeon should be, proper socially acceptable manners should be observed. The purpose of these manners is to put the patient at ease that the physician is an empathetic person with the self-awareness to recognize the way that he or she appears to other people. The manners that the physician projects affect the credibility of the subsequent interactions. These conventions extend to the type

of dress that is worn in a professional setting. The details of whether a physician wears a white coat or formal business clothing (suits, ties, pantsuits, blouses, skirts, etc) are best left to local custom and practice. However, the mode of dress in general should be neat, clean, and formal rather than casual, and not distracting to the interaction.

Another aspect to professionalism is the capability of the physician to do the right thing for the patient and the family even when that course is difficult or unpleasant. This includes such situations as frankly and openly disclosing errors made during care, or delivering bad news about new or unexpected diagnoses. While human nature can make these interactions difficult, the professional must rise to the task and perform it well. Avoiding the opportunity to do so not only obviates the professional's role as advisor on the issue at hand, but affects the physician's credibility in the remainder of that therapeutic relationship.

Interactions With Health Care Personnel

Surgeons frequently work in complex, multilayered organizations. The behavior of the surgeon within this group should always remain productive and patient-centered. In any complex organization with multiple people and personalities, conflicts arise. In that context, it is not appropriate for the surgeon to necessarily shrink from the conflict, but rather the surgeon should take up the role of constructive evaluator and team builder to resolve the issue. At all times, the surgeon must avoid personal attacks on people based upon their personal characteristics, but may legitimately criticize behavior. Professional comportment in these matters will be rewarded with progress in resolving the issue.

Reputation is a fragile and valuable commodity. All health care professionals have a reputation, and it works either for or against them in achieving their patient care and professional goals. Careful adherence to professional behavior in dress, speech, manners, and conflict resolution will create the professional reputation that is most advantageous for the surgeon. With a positive reputation, the surgeon's behavior in ambiguous situations will be interpreted in a benevolent way. The reputation of any clinician is as valuable as their education or certification.

SYSTEMS-BASED PRACTICE

Systems-based practice is one of the core competencies defined by the ACGME as a necessary skill to be developed by graduate medical trainees. These residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. The process of teaching and learning, systems-based practice has been in place for many years. This is what might be considered the practical part of graduate medical training. However, it is only more recently that it has become a focus and metric for performance by training programs.

As a part of training then, residents must learn how different types of medical practice and health care delivery systems differ from one another, including methods that they use to control health care costs and allocate resources. They must use this knowledge to practice cost-effective health care and resource allocation that limits the compromise of quality of care. They must advocate for quality patient care and assist patients in dealing with complexities of the health care delivery system. They must also understand how to work with health care managers and other collaborating health care providers to assess, coordinate, and improve health care for patients.

In practice, this is easier to understand. The role of the resident in identifying both the health care needs of the patient and the capability of the system to meet those needs is well-established. Surgery residents in their senior years are often important resources for hospital systems by understanding how to manipulate the system to meet the needs of the patient. Medical students and surgical trainees must also recognize their role as a part of these complex systems.

Reference

Rowland PA, Lang NP. *Communication & Professionalism Competencies: A Guide for Surgeons*. Woodbury CT: Cine-Med; 2007.

MULTIPLE CHOICE QUESTIONS

1. All of the following are true of the Principles of Medical Ethics, except

   A. Beneficence and nonmaleficence are synonyms
   B. Justice addresses the distribution of medical care among patients and populations
   C. Autonomy includes the concept that the patient has the right to choose or refuse their treatments.
   D. Beneficence asserts that a practitioner should act in the best interest of the patient, without regard to physician's self-interest
   E. Autonomy requires physicians to consult and obtain patient agreement before doing things to them

2. The LCME and the ACGME

   A. Both accredit institutions to provide education or training
   B. Provide diplomas and credentialing to individual practitioners
   C. Conduct periodic reviews to ensure that institutions maintain their programs
   D. Are units of the US Department of Commerce
   E. Both A and C are true

3. ACGME general competencies include all of the following except

   A. Interpersonal and communication skills
   B. Professionalism
   C. Technical skills
   D. Practice-based learning
   E. Systems-based practice

4. The American Board of Surgery and the American College of Surgeons

   A. Are both part of the American Medical Association
   B. Both report directly to the Surgery RRC of the ACGME
   C. Work together to accredit individuals to practice general surgery
   D. Are separate organizations that credential surgeons, and educate surgeons, respectively, as primary parts of their missions
   E. A and C

5. Effective communication with patients requires

   A. Demonstrated respect for the patient as a person
   B. Effective listening to the patient's message
   C. Clarity in the physician's response to the patient
   D. Family members who can reinforce the messages
   E. A, B, and C

Preoperative Preparation

3

David McAneny, MD

INTRODUCTION

The preoperative management of any patient is part of a continuum of care that extends from the surgeon's initial consultation through the patient's full recovery. While this ideally involves a multidisciplinary collaboration, surgeons lead the effort to assure that correct care is provided to all patients. This involves the establishment of a culture of quality care and patient safety with high, uniform standards. In addition, the surgeon is responsible for balancing the hazards of the natural history of the condition if left untreated versus the risks of an operation. A successful operation depends upon the surgeon's comprehension of the biology of the patient's disease and keen patient selection.

This chapter will consider preoperative preparation from the perspectives of the patient, the operating room facility and equipment, the operating room staff, and the surgeon.

PREPARATION OF THE PATIENT

History & Physical Examination

The surgeon and team should obtain a proper history from each patient. The history of present illness includes details about the presenting condition, including establishing the acuity, urgency, or chronic nature of the problem. Inquiries will certainly focus on the specific disease and related organ system. Questions regarding pain can be guided by the acronym OPQRST, relating to Onset (sudden or gradual), Precipitant (eg, fatty foods, movement, etc), Quality (eg, sharp, dull, or cramps), Radiation (eg, to the back or shoulder), Stop (what offers relief?), and Temporal (eg, duration, frequency, crescendo-decrescendo, etc). The presence of fevers, sweats, or chills suggests the possibility of an acute infection, whereas significant weight loss may imply a chronic condition such as a tumor. The history of present illness is not necessarily confined to the patient interview. Family members or guardians provide useful information, and outside records can be indispensable. Documents might include recent laboratory or imaging results that preclude the need for repetitive, costly testing. The surgeon should request CD-ROM disks of outside imaging, if appropriate. In the case of reoperative surgery, prior operative reports and pathology reports are essential (eg, when searching for a missing adenoma in recurrent primary hyperparathyroidism).

The past medical history should include prior operations, especially when germane to the current situation, medical conditions, prior venous thromboembolism (VTE) events such as deep vein thromboses (DVT) or pulmonary emboli (PE), bleeding diatheses, prolonged bleeding with prior operations or modest injuries (eg, epistaxis, gingival bleeding, or ecchymoses), and untoward events during surgery or anesthesia, including airway problems. One must secure a list of active medications, with dosages and schedule. Moreover, it is beneficial to inquire about corticosteroid usage within the past 6 months, even if not current, to avoid perioperative adrenal insufficiency. Medication allergies and adverse reactions should be elicited, although knowledge about environmental and food allergies is also valuable and should be recorded so that these exposures are avoided during the hospital stay. Some anesthesiologists are reluctant to use propofol in patients with egg allergies, and reactions to shellfish suggest the possibility of intolerance of intravenous iodinated contrast agents.

The social history classically involves inquiries into tobacco, alcohol, and illicit drug usage, but this moment also offers the opportunity to establish a personal relationship with patients (and their loved ones). It is fun and often stimulating to learn about patients' occupations, avocations, exercise, interests and accomplishments, fears and expectations, and family lives. Patients' regular activities offer insight into physiologic reserve; an elite athlete should tolerate nearly any major operation, whereas a frail, sedentary patient can be a poor candidate for even relatively minor operations.

A family history includes queries pertinent to the patient's presenting condition. For example, if a patient with a colorectal cancer has relatives with similar or other malignancies, genetic conditions such as familial adenomatous polyposis or hereditary nonpolyposis colorectal cancer could be indicted. This scenario would have screening implications for both the patient and family members. In addition, one should also elicit a family history of VTE complications, bleeding disorders, and anesthesia complications. For example, a sudden and unexpected death of a relatively young family member during an operation could suggest the possibility of a pheochromocytoma, particularly in the setting of a medullary cancer or related endocrine disorder. A strong family history of allergic reactions might imply hypersensitivity to medications.

A review of systems assesses the patient's cardiovascular, pulmonary, and neurologic status, including questions about exertional chest pain or dyspnea, palpitations, syncope, productive cough, or central nervous symptoms. It is also important to have a basic understanding of the patient's symptoms relative to other major organ systems. For example, while one might not necessarily expect an orthopedic surgeon to have an interest in a patient's gastrointestinal or genitourinary habits or problems, these issues may bear grave consequences if a patient experiences postoperative incontinence following joint replacement. Regardless of degree of specialization, surgeons and their designated teams are capable of identifying and investigating potentially confounding conditions.

A thorough physical examination is also an essential part of the patient assessment. Even if the surgeon already knows from imaging that there will be no pertinent physical findings, human touch and contact are fundamental to the development of a trusting physician-patient relationship. In addition to the traditional vital signs of pulse, blood pressure, respiratory rate, and temperature, for many operations it is also important to record the patient's baseline oxygen saturation on room air, weight, height, and body mass index (BMI). The physical examination includes an assessment of general fitness, exercise tolerance, cachexia, or obesity, as well as focusing on the patient's condition. Additional observations may detect findings such as cardiopulmonary abnormalities, bruits, absent peripheral pulses or bruits, adenopathy, skin integrity, incidental masses, hand dominance, neurologic deficits, or deformities. A thorough abdominal examination may include digital anorectal and pelvic examinations. The surgeon should also appreciate potential airway problems, particularly if general anesthesia is anticipated.

Preoperative Testing

Laboratory and imaging investigations are tailored to the individual patient's presenting condition, as discussed in later chapters. However, there should be no "routine" battery of preoperative laboratory studies for all patients. In fact, published data do not support an association between routine studies and outcome. In addition, laboratory tests are costly and may result in harm due to false-positive and fortuitous findings. Instead, tests should be selected based upon the patient's age, comorbidities, cardiac risk factors, medications, and general health, as well as the complexity of the underlying condition and proposed operation. For example, children uncommonly require preoperative laboratory tests for most operations. On the other hand, a complete blood count, chemistries, and an electrocardiogram are proper for high-risk patients before complex operations. Algorithms and grid matrices are available to individualize the selection of preoperative tests (Table 3–1). Importantly, each system should establish a practice for managing abnormal test results, whether germane to the patient's active condition or a serendipitous finding.

A complete blood cell count and basic chemistries are reasonable for some operations, but their likelihood of predicting abnormal or meaningful results should be considered. Coagulation factors such as prothrombin time (PT), international normalized ratio (INR), and partial thromboplastin time (PTT) are not routinely indicated but should be pursued when patients report prolonged bleeding or the usage of anticoagulants. Moreover, INR and PTT may be warranted for operations that have little threshold for intraoperative or postoperative bleeding, such as those on the brain, spine, or neck. Bile duct obstruction, malnutrition, or an absent terminal ileum can affect vitamin K absorption, and a preoperative assessment of INR is important in those instances as well. A pregnancy test (eg, urine beta-human chorionic gonadotropin [beta-HCG]) should be performed shortly before surgery on women with childbearing potential. Other laboratory testing will be dictated by specific conditions, including liver chemistries, tumor markers, and hormone levels. A blood bank specimen should be selectively submitted in advance of operations that are associated with significant hemorrhage or in the setting of anemia with prospects for further blood loss. The preparation of blood for transfusion is costly, so blood-typing alone may suffice without actual cross-matching.

Routine preoperative testing of blood glucose is an intriguing concept, given the relationship between elevated blood sugars and surgical site infections (SSIs), although hemoglobin A_{1C} levels have not correlated with postoperative infections. Some reckon that nondiabetic patients comprise 30%-50% of cases with perioperative hyperglycemia, perhaps constituting an argument for measuring preoperative glucose levels in all candidates for major operations. While it is accepted that diabetic patients require close monitoring of perioperative glucose levels, including immediately before the operation, the value of doing this for all patients is evolving and warrants thoughtful investigation.

Table 3–1. Sample preoperative testing grid.

	CBC	Basic Chemistries	INR or PT	PTT	Liver Chemistries	Urinalysis	EKG	CXR	Urine Pregnancy Test
Cardiac disease (MI, CHF, pacemaker/AICD, coronary stents)	X						X		
Pulmonary disease (COPD, active asthma)	X						X	X	
End-stage renal disease on dialysis	X	X					X		
Renal insufficiency	X	X							
Liver disease	X	X	X		X				
Hypertension							X		
Diabetes		X					X		
Vascular disease	X						X		
Symptoms of urinary tract infection						X			
Chemotherapy	X	X							
Diuretics		X							
Anticoagulants			X	X					
Major operation (eg, cardiac, thoracic, vascular, or abdominal)	X	X					X	X	
Menstruating women									X

AICD, automated implantable cardioverter-defibrillator; CBC, complete blood count; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; CXR, chest radiograph; EKG, electrocardiogram; INR, international normalized ratio; MI, myocardial infarction; PT, prothrombin time; PTT, partial thromboplastin time.
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Some investigators have advocated routine nasal swab screening to identify carriers of *Staphylococcus aureus*. The results can guide decontamination measures such as intranasal application of antibiotic ointment (eg, mupirocin) and local hygiene with 2% chlorhexidine showers for 5 days before surgery. Patients with methicillin-resistant *S aureus* (MRSA) receive appropriate antibiotic prophylaxis and contact precautions. Although the issue of routine MRSA screening is not fully resolved, this practice may be ideal at least for immunocompromised patients and for those undergoing open cardiac operations and implantations of foreign bodies, particularly in orthopedics and neurosurgery. Prospective wound or abscess culture results should also influence decisions about perioperative antibiotics.

Electrocardiograms are not routinely performed but are justified for patients older than 50 years; those having vascular operations; and those with a history of hypertension, cardiac disease, significant respiratory disease, renal dysfunction, and diabetes mellitus. Chest radiographs are no longer performed on a regular basis but are primarily reserved for patients with malignancies or perhaps with significant pulmonary disease. Further special tests are selectively obtained when clinically indicated and often with guidance from consultants; these tests may include echocardiography, cardiac stress testing, baseline arterial blood gases, and pulmonary function tests. Carotid ultrasonography may be valuable in patients with carotid bruits or histories of cerebrovascular accidents or transient ischemia attacks. Noninvasive venous studies may be considered in patients who have had prolonged immobility and/or hospital stays before surgery.

PREOPERATIVE PROCESS

At its simplest, the process of preparing a patient for an operation can involve a rapid assessment in the clinic or

emergency room followed by an expeditious trip to the operating room. However, like most care in the contemporary health care system, the process is more commonly complex and involves a formal series of integrated steps to assure best outcomes. It is incumbent upon the surgery team to create an efficient and cost-effective preoperative system and scheduling protocol that result in optimally prepared patients, rare cancellations of operations, and few disruptions of the operating room schedule. A systemic approach to patient preparation focuses upon risk assessment and reduction, as well as education of the patient and family. This effort begins during the first encounter with the surgeon and continues through the moments before the operation. Ideal preoperative systems assign risk based upon evaluations that are derived from sound published evidence and best practices and driven by standardized algorithms to identify and then modify hazards before operations.

Risk Assessment & Reduction

Overview

The essence of preparing a patient for an operation regards considering whether the benefits of the operation justify the risks of doing harm, along with deciding how to minimize or eliminate those hazards. The American Society of Anesthesiologists (ASA) classification system (Table 3–2) stratifies the degree of perioperative risk for patients. While somewhat rudimentary, this system has faithfully served anesthesiologists and surgeons in predicting how well patients might tolerate operations, and the scores have been validated by several recent publications. The Acute Physiology and Chronic Health Evaluation (APACHE II and III) is an example of a severity of illness scoring system that may be applied to intensive care unit patients to predict mortality. The value of such assessments lies in numerically designating the severities of patients' conditions, permitting comparisons of outcomes.

The University Health Systems Consortium (UHC) analyses derive from inpatient administrative and financial datasets to predict risk-adjusted outcomes for mortality, lengths of stay, and cost of care. The vagaries of medical coding can result in discrepancies, and the UHC system does not monitor patients after hospital discharge. Nevertheless, UHC data can identify deficiencies in practice. Although clinical databases are more costly and challenging to implement than commercially available products such as the UHC program, they provide more robust risk-adjusted outcomes data. Examples of clinical databases include those from the Society of Thoracic Surgeons (STS) and the National Surgical Quality Improvement Program (NSQIP). In NSQIP, dedicated nurses prospectively collect and validate an established panel of defined patient variables, comorbidities, and outcomes, and they pursue surveillance for 30 days after hospital discharge. The NSQIP analysis considers patient

Table 3–2. American Society of Anesthesiologists (ASA) classification system.

ASA Classification	Preoperative Health Status	Example
ASA 1	Normal healthy patient	No organic, physiologic, or psychiatric disturbance; excludes the very young and very old; healthy with good exercise tolerance
ASA 2	Patients with mild systemic disease	No functional limitations; has a well-controlled disease of one body system; controlled hypertension or diabetes without systemic effects, cigarette smoking without chronic obstructive pulmonary disease (COPD); mild obesity, pregnancy
ASA 3	Patients with severe systemic disease	Some functional limitation; has a controlled disease of more than one body system or one major system; no immediate danger of death; controlled congestive heart failure (CHF), stable angina, former heart attack, poorly controlled hypertension, morbid obesity, chronic renal failure; bronchospastic disease with intermittent symptoms
ASA 4	Patients with severe systemic disease that is a constant threat to life	Has at least one severe disease that is poorly controlled or at end stage; possible risk of death; unstable angina, symptomatic COPD, symptomatic CHF, hepatorenal failure
ASA 5	Moribund patients who are not expected to survive without the operation	Not expected to survive > 24 h without surgery; imminent risk of death; multiorgan failure, sepsis syndrome with hemodynamic instability, hypothermia, poorly controlled coagulopathy
ASA 6	A declared brain-dead patient whose organs are being removed for donor purposes	

factors, effectiveness of care, and random variation, and logistic regression models calculate risk-adjusted 30-day morbidity and mortality. These data are reported as odds ratios for comparison with expected outcomes, allowing for the severity of the patients' illnesses. Immediate benefits of NSQIP present the ability to identify true risk-adjusted data and local opportunities for improvement. For example, Veterans Administration (VA) surgeons reduced postoperative mortality from 3.2% in 2003 to 1.7% in 2005, while the complication rate declined from 17% to 10% ($p < 0.0001$). This effort focuses upon systems of care, providing reliable data to assess and reduce risks associated with operations. When compared to UHC, NSQIP is much more likely to identify complications because of its surveillance of patients 30 days beyond their hospitalizations.

The NSQIP program has also generated a tremendous repository of data to develop "risk calculators" for a variety of operations and conditions, allowing preoperative risk assessments and hopefully facilitating significant reductions of preoperative hazards. Finally, NSQIP participants have fostered a culture of sharing best practices and processes, both within the published literature and through formal and personal collaborations.

Beyond the obvious physical and emotional implications of adverse outcomes for patients and their families, the financial costs of postoperative complications to the health care system are staggering. It has been postulated that a major postoperative complication adds over $11,000 to the cost of the hospital care of an affected individual and significantly extends the duration of the inpatient confinement. In fact, the total cost of care increases by more than half when a complication develops. Notably, respiratory complications may increase the cost of care by more than $52,000 per patient. Strikingly, data from NSQIP have demonstrated that the occurrence of a serious complication (excluding superficial wound infections) after major operations is an independent risk factor for decreased long-term survival. Therefore, it is crucial that efforts focus upon reducing and eliminating postoperative complications.

Well-designed, systematic preoperative assessment programs can prospectively identify predictors of various complications and drive the ability to attenuate risks and improve outcomes. The perspective of teams of surgeons, physicians, nurses, and others with expertise managing standardized, algorithm-driven preoperative evaluations, often with checklists, is a departure from traditional care that primarily involved solitary surgeons with disparate practices. The new paradigm recognizes that variability in practice is the enemy of efficiency.

The financial dividends appreciated from enhanced results and diminished death and complication rates more than compensate for the expenditures associated with quality improvement efforts and participation in auditing programs such as NSQIP. It is essential that surgeons monitor their patients' outcomes, preferably in a risk-adjusted fashion, to understand their practices and to demonstrate opportunities for improvement.

Cardiovascular

In 1977, Goldman published a multifactorial index for assessing cardiac hazards among patients undergoing noncardiac operations. The same group issued a Revised Cardiac Risk Index (RCRI) in 1999, reporting six independent predictors of cardiac complications. These include a history of ischemic heart disease, congestive heart failure, cerebrovascular disease, a high-risk operation, preoperative treatment with insulin, and a preoperative serum creatinine greater than 2.0 mg/dL. The likelihood of major cardiac complications increases incrementally with the number of factors present. Contemporary NSQIP data have led to the development of a risk calculator to predict postoperative cardiac complications. A multivariate logistic regression analysis demonstrated five prognostic factors for perioperative myocardial infarction (MI) or cardiac arrest: the type of operation, dependent functional status, abnormal creatinine, ASA class, and increasing age. The analysis has been validated and has led to the composition of an interactive risk calculator. Another multivariate model demonstrated criteria that predict adverse cardiac events among patients who have had elective vascular operations, and it also suggests improved predictive accuracy among these patients compared to the RCRI. Independent hazards include increasing age, smoking, insulin-dependent diabetes, coronary artery disease, congestive heart failure (CHF), abnormal cardiac stress test, long-term beta-blocker therapy, chronic obstructive pulmonary disease, and creatinine ≥1.8 mg/dL. Conversely, the analysis demonstrated a beneficial effect of prior cardiac revascularization. There is obviously overlap among the factors identified in these models.

The determination of an increased chance of a patient developing postoperative cardiac complications will certainly influence the tenor of preoperative discussions with patients and their family members, especially if the surgeon can present validated data regarding the actual likelihood of a cardiac complication or death. In addition, correctable hazards may be addressed, including smoking cessation, optimal control of diabetes, hypertension, and fluid status, and assurance of compliance with medical measures. Finally, formal risk assessments guide cardiologists with respect to cardiac stress testing, echocardiography, and coronary catheterization among higher-risk patients. Selected patients may be candidates for preoperative revascularization, either with coronary artery stent placement or surgical bypass.

The American College of Cardiology (ACC) Foundation and the American Heart Association (AHA) periodically issue joint recommendations about the cardiac evaluation and preparation of patients in advance of noncardiac

operations. These guidelines are evidence based, include an explanation of the quality of the data, and provide comprehensive algorithms for the propriety of testing, medications, and revascularization to assure cardiac fitness for operations. As important as preoperative cardiac risk stratification is, a cardiology consultation also lays the groundwork for postoperative risk assessment and later modifications of coronary risk factors.

Noninvasive and invasive preoperative testing should be performed only when the results will influence patient care. Noninvasive stress testing before noncardiac operations is indicated in patients with active cardiac conditions (eg, unstable angina, recent MI, significant arrhythmias, or severe valvular disease), or in patients who require vascular operations and have clinical risk factors and poor functional capacity. Good data support coronary revascularization before noncardiac operations in patients who have significant left main coronary artery stenosis, stable angina with three-vessel coronary disease, stable angina with two-vessel disease and significant proximal left anterior descending coronary artery stenosis with either an ejection fraction < 50% or ischemia on noninvasive testing, high-risk unstable angina or non–ST-segment elevation MI, or acute ST-elevation MI. However, current data do not support routine preoperative percutaneous revascularization among patients with asymptomatic coronary ischemia or stable angina.

The role of beta-blockers for cardiac protection is evolving, and these agents are no longer empirically advised for all high-risk patients due to potential adverse consequences. Beta-blockers should be continued perioperatively among those patients who are already taking them and among those having vascular operations and at high cardiac risk, including known coronary heart disease or the presence of ischemia on preoperative testing. The role of beta-blockers is uncertain for patients with just a single clinical risk factor for coronary artery disease. Cardiac complication risk calculators may become beneficial in the stratification of patients who should receive beta-blockers to reduce perioperative cardiac complications.

Preoperative aspirin usage should continue among patients at moderate to high risk for coronary artery disease, unless the risk of resultant hemorrhage definitely outweighs the likelihood of an atherothrombotic event. Thienopyridines, such as ticlopidine or clopidogrel, are administered in concert with aspirin as dual antiplatelet therapy following placement of coronary artery stents. They are intended to inhibit platelet aggregation and resultant stent thrombosis, although they certainly increase the risk of hemorrhage. Therefore, if an operation can be anticipated, the surgeon and cardiologist must coordinate efforts regarding the sequence of the proposed operation and coronary stenting, weighing the hazards of operative bleeding while on antiplatelet therapy for a stent versus potential postoperative coronary ischemia. Elective operations with a significant risk of bleeding should be delayed 12 months before the discontinuation of the thienopyridine in the presence of a drug-eluting stent, at least 4-6 weeks for bare-metal stents, and 4 weeks after balloon angioplasty. Therefore, if a patient requires percutaneous coronary artery intervention prior to noncardiac surgery, bare-metal stents or balloon angioplasty should be employed rather than drug-eluting stents. Even when thienopyridines are withheld, aspirin should be continued, and the thienopyridine is to be resumed as soon as possible after the operation. In circumstances such as cardiovascular surgery, the dual antiplatelet agents are continued throughout the perioperative course to minimize the likelihood of vascular thrombosis.

Pulmonary

Postoperative pulmonary complications (PPC), such as the development of pneumonia and ventilator dependency, are debilitating and costly. They are associated with prolonged lengths of hospital stay, an increased likelihood of readmission, and increased 30-day mortality. Therefore, it is critical to identify patients at greatest risk for PPC. Established risk factors for PPC include advanced age, elevated ASA class, congestive heart failure, functional dependence, known chronic obstructive pulmonary disease, and perhaps malnutrition, alcohol abuse, and altered mental status. In addition, hazards are greater for certain operations (eg, aortic aneurysm repair, thoracic or abdominal, neurosurgery, head and neck, and vascular), prolonged or emergency operations, and those done under general anesthesia. A risk calculator was devised to predict the likelihood of PPC occurrence, indicating seven independent risk factors. These include low preoperative arterial oxygen saturation, recent acute respiratory infection, age, preoperative anemia, upper abdominal or thoracic operations, duration of operation over 2 hours, and emergency surgery.

A multivariable logistic regression has affirmed that active smoking is significantly associated with postoperative pneumonia, SSI, and death, when compared to nonsmokers or those who have quit smoking. Moreover, this is a dose-dependent phenomenon, predicated upon the volume and duration of tobacco consumption. The benefits of preoperative smoking cessation seem to be conferred after an interval of at least 4 weeks. Conversely, the risk of developing PPC is the same for current smokers versus those who quit smoking for less than 4 weeks before an operation. Smoking cessation also confers favorable effects on wound healing. Therefore, patients should be encouraged to stop smoking at least 1 month before operations, ideally with programmatic support through formal counseling programs and possibly smoking cessation aids such as varenicline or transdermal nicotine.

A recent analysis of patients having general surgery and orthopedic operations demonstrated that sleep apnea

is an independent risk factor for the development of PPC. A simple "STOP BANG" questionnaire can screen patients for sleep apnea. The acronym queries *S*noring, *T*ired during day, *O*bstructed breathing pattern during sleep, high blood *P*ressure, *B*MI, *A*ge over 50 years, *N*eck circumference, and male *G*ender. Patients with sleep apnea may be managed with continuous positive pressure (CPAP) or bilevel positive airway pressure (BiPAP) devices, both before and after operations. The presence of sleep apnea may also influence anesthesia techniques.

Patients identified as being at highest risk for the development of PPC may benefit from preoperative consultations with respiratory therapy and pulmonary medicine experts. Pulmonary function tests and baseline arterial blood gas tests guide the care of select patients, especially those anticipating lung resections. In addition to smoking cessation, asthma should be medically controlled. Patient education focuses upon inspiratory muscle training (including the usage of incentive spirometry), the concepts of postoperative mobilization, deep inspiration, and coughing, along with oral hygiene (tooth brushing and mouth washes). Respiratory therapists can provide expertise with CPAP and BiPAP systems for patients with sleep apnea. Surgeons and anesthesiologists should collaborate regarding plans for neuromuscular blocking agents and strategies to reduce pain, including the administration of epidural analgesics and the consideration of minimally invasive techniques to avoid large abdominal or thoracic incisions. Finally, formal intensive care unit protocols can promote liberation from ventilator support.

Venous Thromboembolism

Venous thromboembolism (VTE) events such as DVT or PE are major complications that can lead to death or serious long-term morbidity, including chronic pulmonary hypertension and postthrombotic limb sequelae. Scoring systems stratify patients by their probability of developing a postoperative VTE to guide preventative measures. In the 2012 American College of Chest Physicians (ACCP) recommendations, the patient's score selects the alternatives of early ambulation alone (very low risk), mechanical prophylaxis with intermittent pneumatic compression (IPC) devices (low risk), options of low-molecular-weight heparin (LMWH) or low-dose unfractionated heparin or IPC (moderate risk), and IPC in addition to either LMWH or low-dose heparin (high risk). Furthermore, an extended course (4 weeks) of LMWH may be indicated among patients undergoing resections of abdominal or pelvic malignancies. Of course, the surgeon must entertain the hazards of pharmacologic prophylaxis when bleeding poses even greater harm than VTE, in which case IPC alone may suffice. Heparin prophylaxis is associated with a 4%-5% chance of wound hematomas, 2%-3% incidence of mucosal bleeding and the need to stop the anticoagulation, and a 1%-2% risk of reoperation. The ACCP 2012 guidelines do not advocate routine vein surveillance with ultrasonography or the insertion of inferior vena cava filters for primary VTE prevention. Notably, antiembolism graduated compression stockings (GCS) do not promote venous blood flow from the leg and can violate skin integrity and result in the accumulation of edema. The efficacy of stocking for VTE prevention is unproven.

Caprini has developed a more elaborate risk calculation that has been validated in a variety of clinical settings and specialties, and is adaptable to standardized order sets (Figure 3–1). This scoring system acknowledges the gravity of individual hazards, including personal and family histories of VTE, the diagnosis of a malignancy, a history of obstetrical complications or known procoagulants, and prolonged operations, among several other factors. It also identifies patients who may either entirely avoid anticoagulation or benefit from an extended duration of LMWH. There is no doubt that the cumulative incidence of VTE extends many weeks after operations, particularly for malignancies and in an era when the duration of hospital stays (and inpatient prophylaxis) has declined. In fact, about one-third to half of patients who manifest a postoperative VTE after cancer surgery do so following hospital discharge. Therefore, regimens of pharmacologic prophylaxis should be maintained after the discharge of patients who have elevated risk scores. The ACCP and Caprini systems are two among several VTE risk assessment tools, each of which has advantages and disadvantages. The system adopted in any hospital or surgery center will be a function of local resources and culture, but it is ideal that surgeons develop and maintain a local standard to minimize the threat of postoperative VTE.

Diabetes Mellitus

Patients with diabetes mellitus are more likely to undergo operations than are those without diabetes, and their care is associated with longer lengths of hospital stay, increased rates of postoperative death and complications, and relatively greater utilization of health care resources. It has been established that elevated postoperative blood glucose levels in diabetic patients translate to progressively greater chances of SSIs following cardiac operations, as well as a greater likelihood of postoperative infections and prolonged hospital stays in patients with noncardiac operations. In fact, increased perioperative glucose levels have correlated with a higher risk of SSIs in general surgery, cardiac surgery, colorectal surgery, vascular surgery, breast surgery, hepatobiliary and pancreas surgery, orthopedic surgery, and trauma surgery. The relative risk of an SSI seems to incrementally increase in a linear pattern with the degree of hyperglycemia, with levels greater than 140 mg/dL being the sole predictor of SSI upon multivariate analysis. In one study, the likelihood of an adverse postoperative outcome increased by