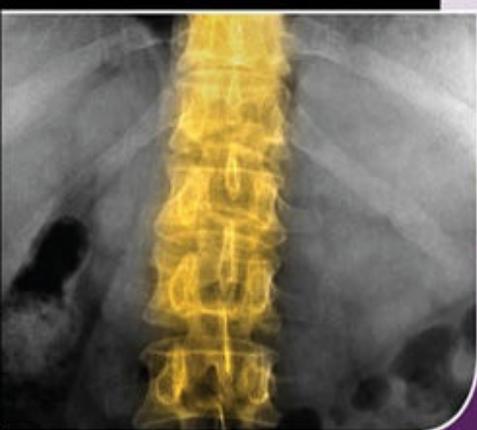


5th Edition

CURRENT

Diagnosis & Treatment



Orthopedics

HARRY B. SKINNER | PATRICK J. McMAHON

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CURRENT

Diagnosis & Treatment

in Orthopedics

FIFTH EDITION

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ISBN: 978-0-07-183970-9

MHID: 0-07-183970-4

The material in this books also appears in the print version of this title: ISBN: 978-0-07-159075-4, MHID: 0-07-159075-7.

eBook conversion by codeMantra

Version 1.0

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*To my daughters Lacey and Lauren, whose intelligence and beauty
astonish me each and every day of my life. They have given me
inspiration and motivation to complete this book.*

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Orthopedic Infections: Basic Principles of Pathogenesis, Diagnosis, and Treatment

Preface

This *Current Diagnosis and Treatment in Orthopedics* is the Fifth Edition of the Orthopaedic Surgery contribution to the Lange Current Series of books. It is surprising to realize that it has been 16 years since the first edition of this book. Much has changed in orthopedics since the first edition came out, but the goal of this book has not changed. It is intended to fill a need for a ready source of up-to-date information on disorders and diseases treated by orthopedic surgeons and related physicians. The format in this edition is unchanged from the previous edition: there is emphasis on the major diagnostic features of disease states, the natural history of the disease where appropriate, the workup required for definitive diagnosis, and finally, definitive treatment. The book focuses on orthopedic conditions, deemphasizing the treatment of the patient from a general medical viewpoint, except when it pertains to the orthopedic problem under consideration. Importantly, pathophysiology, epidemiology, and pathology are included when they assist in arriving at a definitive diagnosis or an understanding of the treatment of the disease or condition. In many conditions, such as infection or neoplasm, it is extremely important to understand the pathophysiology because the disease may be encountered at various time points in the progression of the disease.

This edition of *Current Diagnosis and Treatment in Orthopedics* is truly current. The entire book has been updated in its references to include only those references since 2005, except in cases where classic articles are necessary to refer back to major advances in understanding or treatment, or in situations where there has been little change in the subspecialization in orthopedics, such as rehabilitation. These selected references to the older literature represent landmarks in the advancement of the understanding of orthopedic diseases and conditions and serve as useful sources of the fundamental basis for understanding these diseases and conditions.

INTENDED AUDIENCE

The unique format of the Lange series textbooks allows readers of many levels of understanding to derive benefit from the information.

Students will find that the book encompasses virtually all aspects of orthopedics that they will encounter in classes and as subinterns in major teaching institutions. Residents and house officers can use the book as a ready reference covering the majority of disorders and conditions in emergency and elective orthopedic surgery. Despite its small size, it is truly comprehensive. Because of the organization of the book on a subspecialty basis, review of individual chapters will provide house officers rotating on subspecialty orthopedic services with an excellent basis for further in-depth study.

For emergency room physicians, especially those with medical backgrounds, the text provides an excellent resource in managing orthopedic problems seen on an emergent basis. Similarly, family practice, pediatricians, general practitioners, and internists will find the book particularly helpful in the referral decision process and as a resource to explain disorders to patients. Finally, practicing orthopedic surgeons, particularly those in subspecialties of orthopedics, will find the book a helpful resource in reassuring them that their treatment in areas outside their subspecialty interest is current and up-to-date.

ORGANIZATION

The book is structured similarly to the structure of orthopedic surgery. Natural subspecialization has occurred in orthopedic surgery over the years, which has resulted in some overlap in anatomic areas. This has resulted in the book having some overlap and some artificial division of subjects. Because of the primarily subspecialization structure, the reader is encouraged to read entire chapters or, for more discrete topics, go directly to the index for information. For example, the house officer rotating on the pediatric orthopedic service would find reading the pediatric chapter to be a prudent method of developing a baseline knowledge in pediatric orthopedic surgery. Knee problems, however, might be best approached by looking in the sports medicine chapter or in the adult reconstruction chapter, since these areas overlap, mostly in age of patient.

The first chapter introduces aspects of interest in the perioperative care of the orthopedic patient, including social aspects of the patient/physician relationship. This is a new addition and is an outgrowth of the importance of outcomes in orthopedics. Management of orthopedic problems arising from trauma is covered in [Chapter 2](#), while [Chapter 3](#) deals with sports medicine with an emphasis on the knee and shoulder. [Chapter 4](#) covers all aspects of spine surgery, including infection of the spine, degenerative spinal problems, spinal deformity, and spinal trauma.

[Chapter 5](#) provides comprehensive coverage of tumors in orthopedic surgery, including benign and malignant soft-tissue and hard-tissue tumors. Adult joint reconstruction, including the disorders that lead to joint reconstruction, are covered in [Chapter 6](#). In [Chapter 7](#), infections, with their special implications for orthopedic surgery, are covered. [Chapter 8](#) discusses foot and ankle surgery, and [Chapter 9](#), hand surgery. [Chapter 10](#) covers diseases in orthopedics unique to children. The final two chapters deal with amputation and all aspects of rehabilitation fundamental to orthopedic surgeons in returning patients to full function.

OUTSTANDING FEATURES

Illustrations have been carefully selected to maximize their benefits in pointing out orthopedic principles and concepts. The effect of changes in imaging technology on

optimal diagnostic studies is emphasized, including cost-effectiveness.

Bone and soft tissue tumor differential diagnoses are simplified by comprehensive tables that categorize tumors by age, location, and imaging characteristics. The molecular basis of the current understanding of tumor etiology is expanded.

Concise, current, and comprehensive treatment of the basic sciences underlying the understanding of orthopedic surgery is provided in individual chapters, where pertinent.

NEW TO THIS EDITION

- Information on shoulder evaluation has been widely expanded, including tables to elucidate the diagnosis of shoulder problems.
- Advances in treatment of back pain, including disk replacement, are included.
- The latest on molecular biology of neoplasms has been expanded in the musculoskeletal tumor section.
- Surgical management of osteoporosis, including techniques such as kyphoplasty and vertebroplasty, and information on shoulder replacement have been widely expanded.
- Guidelines for predicting function, such as ambulatory capability after spinal cord injury, are updated.
- New materials in orthopedics that are making changes in the way replacement arthroplasty is performed are included.
- Hip conditions amenable to arthroscopic treatments are discussed.
- The latest information on important growth factors in orthopedics is elucidated with their current usage.

We are pleased to be able to say, with the concurrence of our coauthors, that these new features added to the information in the previous edition make this edition a significant improvement over the last.

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General Considerations in Orthopedic Surgery

Harry B. Skinner, MD, PhD

Orthopedic surgery encompasses the entire process of caring for the surgical patient, from diagnostic evaluation to the preoperative evaluation and through the postoperative and rehabilitative period. Although the surgical procedure itself is the key step toward helping the patient, the preliminary and follow-up care can determine whether the surgery is successful.

DIAGNOSTIC WORKUP

► History and Physical Exam

Although it may seem obvious, the history and physical exam are still important in the evaluation of the patient. Every office visit is a history and physical exam, whether a new or a return visit. The completeness of the history and physical has assumed new importance in view of the complexities required for compliance with federal regulations. Regulations require that a chief complaint be specified, and this must be clearly defined because it determines the direction for the rest of the history and physical. The history must address the key features of the problem, both to elucidate the medical problem and to cover the subsidiary requirements for billing purposes. The social history and past medical history are similarly important because they change billing codes without necessarily affecting outcome or success of care. The physical again must cover the essentials necessary for diagnosis, and frequently the confirmation of the diagnosis is based on physical exam, but such considerations as skin condition and blood supply must be documented, despite the fact that this process is also part of the surgical evaluation. The next step is imaging and laboratory exams. The most important point here is to use the most cost-effective examination possible while keeping patient safety, satisfaction, and convenience in mind.

► Imaging Studies

A. Roentgenography

Roentgenography is still the most cost-effective and most important initial diagnostic test in the orthopedist's armamentarium. Almost every patient should have a radiograph prior to going to a more sophisticated imaging study. Certain situations are obvious; for example, a 68-year-old man with knee pain should have standing, flexed-

knee posteroanterior (PA), lateral, and merchant plain film views taken. If those views show normal joint spaces, consideration of intraarticular pathology, such as a degenerative meniscus tear, can be worked up with magnetic resonance imaging (MRI). The normal views usually ordered are as follows:

1. Neck pain—

No history of trauma, more than 4 weeks' duration. Younger than 35 years: anteroposterior (AP) lateral, odontoid.

Older than 35 years: obliques.

History of trauma: flexion/extension laterals (obtain on first visit).

2. Thoracic spine pain and tenderness—

Younger than 40 years, no reason to suspect malignancy: AP and lateral (if history of trauma, or possibility of osteoporosis on first visit, otherwise at 4 weeks).

Consider cervical (C)-spine as a source of referred pain to thoracic (T)-spine if no tenderness in T-spine.

3. Lumbar (L)-sacral (S)-spine—

Younger than 40 years, no reason to suspect malignancy after 4 weeks' duration of the pain. With significant trauma, at first visit, or possible malignancy (ie, weight loss, malaise, fatigue): AP, lateral.

Add obliques for chronic low back pain (ie, spondylolisthesis).

4. Hips—

AP pelvis, lateral of affected hip.

Consider lumbar-sacral (L-S) series if pain is in the buttock rather than in the groin.

5. Knees—

Older than 40 years or history of meniscectomy: Rosenberg, lateral, and sunrise films. Merchant views are similar to sunrise. The Rosenberg view is a 10-degree down shot of the PA of the knees while standing at 45 degrees of flexion.

For other knees: AP, lateral, and sunrise.

In the child, up to age 16, consider a pelvis film with the complaint of knee pain and negative physical exam referable to the knee.

6. Femur, tibia, humerus, forearm—AP and lateral are indicated for trauma, palpable lesions, or suspected tumors.

7. Ankle—AP lateral and mortise.

8. Foot—AP, lateral, and oblique for routine evaluation.

9. Shoulder—AP, axillary, scapular Y, and outlet views.

10. Elbow—AP and lateral (true lateral).

11. Hand/wrist—

Hand: PA and lateral.

Wrist: PA, lateral, and oblique

For suspected instability: clenched fist PA in radial and ulnar deviation.

Follow-up radiographs are obtained when a change in the radiographic findings is

expected. Remember that bone changes occur slowly, so radiographic changes take a comparable length of time. Radiographs are obtained in view of the clinical picture. For example, closed treatment of a distal radius fracture would not be expected to show changes because of healing for a minimum of 2 weeks. However, displacement of the fracture could occur sooner. Hence, radiographs to show displacement might be obtained at 1 week and 2 weeks. If no displacement is observed, the fracture position could be considered stable, and the next films might be obtained at 6 weeks—the earliest time healing might be observed. Similarly, closed treatment of an adult tibia fracture might be followed with radiographs at 2-week intervals, checking for displacement and healing, whereas a tibia fracture treated with an intramedullary rod might be followed at monthly intervals to check for healing.

B. Magnetic Resonance Imaging

This imaging modality is very useful, but like electron beam computed tomography (CT), MRI is sometimes too revealing. This method should be reserved for clarifying a particular problem. Frequently in orthopedics, a bony lesion can be localized with a radiograph or bone scan, which then provides a focus for the MRI. MRI is useful for some bony lesions, such as osteonecrosis, tumors, fatigue fractures, and osteomyelitis. It is also helpful in some soft-tissue problems, such as knee meniscus tears and shoulder rotator cuff tears. Distortion of the magnetic field by metallic implants may limit the usefulness of MRI studies of conditions such as total knee or hip replacement, or fracture fixation devices. MRI should not be used when the diagnosis can be made with a less expensive test. For example, the use of the MRI in knee studies in patients older than 45 years should always be preceded by plain films of the knee, as noted earlier. An MRI of an arthritic knee adds little additional information because the meniscus and anterior cruciate ligament are likely to be damaged from the arthritic process already. However, the MRI can be very helpful in determining soft-tissue extension of tumors or infection.

The advent of new portable MRI units that perform limited studies with more resolution adds a new dimension to their use. These can provide data on the progression of disorders such as rheumatoid arthritis or osteomyelitis in a timely and cost-effective way. The possibility of osteomyelitis in the bones adjacent to ulcers on the foot is easily determined with this test because it shows the changes, typically edema, in the bone with osteomyelitis. A bone scan usually does not have the resolution to distinguish the inflammatory response in the soft tissue from the bony involvement. Osteomyelitis should be treated much differently from a soft-tissue ulcer, which does not affect the bone.

C. Computed Tomography

The CT scan is an extremely important imaging modality for examining bony lesions such as fractures. Frequently, plain films provide some information about the fracture of interest, but the CT scan provides the three-dimensional information that can only otherwise be determined from the integration of the plain films in the surgeon's mind. The CT scan adds significantly to the management of such fractures as tibial plateaus, scapular fractures, ankle fractures, and cervical and lumbar spine fractures, as well as

many others. Furthermore, nonunions of fractures, with or without fixation, can be identified and followed with CT scans. Again, if little information can be gained that cannot be already discerned from the plain films, the CT scan only adds expense and patient inconvenience. The spiral CT makes imaging with this modality less expensive and much more rapid. The CT scan is also now the method of choice for determining whether a pulmonary embolus (PE) has occurred. Again, a CT for this indication is easier on the patient, more accurate, and less invasive than angiography.

D. Technetium-99m Bone Scan

The bone scan finds many uses in orthopedic surgery. Keep in mind that the bone scan labels the osteoblast activity with the radioactive tracer, technetium-99; thus, bone formation activity is recorded, and little or no bone resorption activity is noted. Any disorder that results in increased bone formation, therefore, results in a “hot” bone scan. This means that a disorder such as multiple myeloma may not show up on a bone scan because only osteoclastic activity is involved in the majority of lesions. This test is helpful in discerning loose total hip and total knee prostheses, however, even though the findings are nonspecific. It is very helpful in examining probable benign bone lesions because a cold bone scan largely rules out an aggressive process such as a malignancy. The bone scan is also helpful in diagnosing any disorder of unknown origin when there is pain localized to a particular region. A cold bone scan implies that the problem is a soft-tissue one, whereas a hot bone scan points to a region that may benefit from MRI.

► Laboratory Exams

The two most important laboratory exams are for C-reactive protein and the erythrocyte sedimentation rate. These two tests indicate whether an inflammatory process, malignancy, or rheumatologic disorder is a diagnostic consideration. If these tests are negative, systemic causes of a complaint can frequently be ruled out. In that situation, a more localized disorder should be identified. The next most important test is the complete blood count, which provides the general indication of the patient’s health, revealing information about anemia, infectious processes, and so on. The next most useful laboratory test for the orthopedic surgeon is the synovial fluid analysis. This test typically should include a culture and sensitivity. If there is any concern about infection, a cell count, differential, protein, and glucose measurement should be performed. Crystals should be looked for because they indicate chondrocalcinosis or gout. Elevated protein and reduced glucose levels suggest infection. The final factor that should be considered with any major surgery is the patient’s nutritional status, which is evaluated with several tests, including lymphocyte count and levels of prealbumin, albumin, zinc, and serum iron transferrin. In addition, the Mini Nutritional Assessment is a nursing tool to screen elderly individuals at risk of malnutrition.

► Educating and Informing Patients and Their Families

Surgical procedures in orthopedics have varying degrees of difficulty and importance, ranging from a relatively simple claw toe correction to the performance of a multilevel complex spinal fusion. After the decision to employ surgery as a therapeutic modality is made, it is important to help the patient completely understand what to expect before, during, and after surgery. This process, which the legal profession calls **informed consent**, has the more important purpose of ensuring the patient's cooperation and satisfaction.

To comply with the requirements of the legal profession and accrediting organizations, such as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the surgeon must provide an explanation of the risks, prognosis, alternatives, and complications that might be encountered. The risks should be reviewed in some detail for the general risks encountered in typical orthopedic surgical procedures. The risks and the complications that occur in surgery are intimately associated and thus must be dealt with together. The alternatives are sometimes straightforward. For example, a patient with an open fracture has a high risk of infection if not adequately treated with irrigation, debridement, and antibiotics. Thus, in such a situation, any reasonable and prudent person would consent to the procedure. The choice between alternatives can become significantly more subtle, however. For example, it is possible that a choice must be made between two different procedures or between a particular procedure and no procedure. In this situation, the surgeon must consider the psychosocial and physical attributes of the patient so as to assist him or her in making this decision. For example, consider men, both 75 years of age, with severe degenerative disease in the right knee noted on radiograph. One individual is now at the point where he cannot play golf, a situation that is reducing his physical exercise and a number of his social outlets. The other individual leads a relatively sedentary lifestyle, seldom walks more than a block, and obtains cardiorespiratory exercise by swimming, an activity in which his knee does not bother him. The surgeon should recommend knee replacement to one individual but not the other. At the same time, both men must be offered the alternatives, which include continued nonsteroidal anti-inflammatory medicine, bracing, sleeping medication, and analgesics.

Patients with an active lifestyle are becoming much more concerned about what will happen to them in the postoperative period, including how soon they can safely travel, when they can work, and when they will be fully able to take care of themselves. They are also concerned about what social services are available to help them if they cannot care for themselves fully. The surgeon must be prepared to address these questions and also advise patients with lower extremity or spinal problems about when they will be able to walk. In the same manner, after procedures on the hand or upper extremity, patients must be advised about when they will be able to use the hand. Advising the patient of these situations before surgery can prevent unexpected surprises in the postoperative period.

The patient should also be informed about the range of expectations for ambulation or use of the upper extremity because individuals vary in their response to surgery. For example, patients should be advised that after surgery on the hip or knee, they will need a walker for a few days, move to crutches, and typically be done with the