Surgical Exposures in Orthopaedics

THE ANATOMIC APPROACH

J. B. LIPPINCOTT COMPANY

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Preface

It has often been said that successful orthopaedic procedures are based on a simple principle: "Get to bone and stay there." *Surgical Exposures in Orthopaedics: The Anatomic Approach*, the product of an anatomy course for orthopaedic surgeons that has been run at the Albert Einstein College of Medicine for the past 15 years, expands on the principle. The book explains the techniques of commonly used orthopaedic approaches and relates the regional anatomy of the area relevant to the approach.

Safety in surgery depends on knowledge of anatomy and technical skill. The two go hand in hand; one is useless without the other. Surgical skill can be learned only by practical experience under expert supervision. But the knowledge that underlies it must come from both book and dissection.

Structurally, this book is divided into 11 chapters, each dealing with a particular area of the body. The most commonly performed approaches are described; we have omitted approaches designed only for one specific procedure—they are best understood in the original papers of those who first described them. Nevertheless, the vast majority of orthopaedic procedures can be safely and successfully accomplished through the approaches we have included.

Orthopaedics is a rapidly evolving field. New procedures are appearing at a prodigious rate; some are discarded in a comparatively short time. Thus, any book that concerns itself with the specifics of operative surgery inevitably becomes dated, sometimes even before publication. To avoid this problem, we have concentrated on getting to the bone or joint concerned, and not on what to do after. When applicable, we have included references to individual surgical procedures but without incorporating their details into our textbook.

The key to *Surgical Exposures in Orthopaedics* is a consistent organization throughout (*see* Table 1). Each approach is explained; then the relevant surgical anatomy of the area is discussed. When one or more approaches share anatomy, they are grouped together, with the relevant anatomical section at the end. The idea is for the surgeon to read the approach and anatomy sections together before attempting a given procedure, because once the anatomical principles of a procedure are fully understood, the logic of an approach becomes clear.

SURGICAL APPROACHES

The crucial element in successful surgical approaches is exploiting *internervous planes*. These planes lie between muscles—muscles supplied by different nerves. Internervous planes are helpful mainly because they can be used along their entire length without either of the muscles involved being denervated. These approaches can generally be extended to expose adjacent structures. Virtually all the classic *extensile* approaches to bone use internervous planes—a concept first described by A. K. Henry, who believed that if the key to operative surgery is surgical anatomy, then the key to surgical anatomy is the internervous plane.

The approach sections are structured as follows.

The introduction to each approach describes indications and points out the major advantages or disadvantages of the proposed surgery. Significant dangers are also outlined in this section.

The *position of the patient* is critical to clear, full exposures, as well as to the comfort of the operating surgeon.

Surgical *landmarks* form the basis for any incision; they are described with instructions on how to find them. The *incision* follows these key landmarks. Although the incisions described are generally straight, many

TABLE 1. CHAPTER OUTLINE

I. Surgical Approach
- (Introduction)
- Position of Patient on Operating Table
- Landmarks and Incision
- Internervous Plane
- Superficial Surgical Dissection
- Deep Surgical Dissection
- Dangers
- How to Enlarge the Approach
  - Local Measures
  - Extensile Measures

II. Applied Surgical Anatomy
- Overview
- Landmarks and Incision
- Superficial Surgical Dissection and Its Dangers
- Deep Surgical Dissection and Its Dangers
- Special Anatomical Points

surgeons prefer to use curved or zigzag incisions because they heal with less tension than do equivalent straight incisions.

The approaches often allow exposure of the whole length of a bone; usually, only part of an exposure is required for any given operation.

The surgical dissection has been divided into *superficial* and *deep surgical dissections* for teaching purposes to reinforce the concept that each layer must be developed fully before the next layer is dissected. Adequate exposure depends on a systematic and deliberate technique that exploits each plane completely before deeper dissection begins.

The *dangers* of each approach are listed under four headings: nerves, vessels, muscles and tendons, and special points. The dangers are described, along with how to avoid them.

The approach section concludes with a description of *how to enlarge the approach.* All too often, the suregon discovers that the incised exposure is inadequate. There are two ways in which the exposure can be enlarged: *Local measures* include extending skin incisions, repositioning retractors, detaching muscles, or even adjusting the light source; and *extensile measures* are ways in which an approach can be extended to include adjacent bony structures. In approaches through internervous planes, extensile measures may permit the exposure of the entire length of the bone.

ANATOMICAL SECTIONS

The anatomy of each approach begins with a brief overview of the muscular anatomy, along with the arrangement of the neurovascular structures.

The anatomy of the *landmarks* relates these structures to their surroundings. The anatomy of the *skin incision* describes the angle between the incision and the natural lines of skin cleavage first described by Langer—a relationship that may influence the size and prominence of the resultant scar. Nevertheless, the site of a skin incision must be determined largely by safety and effectiveness and not by cosmetic considerations. Skin incisions generally avoid cutting major cutaneous nerves; where they might, the danger is clearly stated.

The *anatomy of the superficial and deep surgical dissection* discusses the regional anatomy encountered during the approaches—not only the anatomy of the plane to be used but also that of adjacent structures that may appear if the surgeon strays out of plane. Perhaps the greatest value of knowing topographical anatomy is in cases of trauma, where the surgeon may explore wounds with confidence, aware of the potential dangers created by any given wound. Relevant clinical information on the anatomical structures is offered, but a comprehensive clinical picture is beyond the scope of this book. The origins, insertions, actions, and nerve supplies of relevant muscles are listed in legends under the muscles' illustrations.

The anatomical and surgical illustrations are drawn from the surgeon's point of view whenever possible, with the patient on the operating table, so that the surgeon can see exactly how the approach must look when he operates.

The anatomical terms used in *Surgical Exposures in Orthopaedics* are generally those used in modern anatomical textbooks. Terms now in orthopaedic usage sometimes differ from them; when that occurs (for instance, with the flexor retinaculum/transverse carpal ligament), both terms are given. Variation also occurs in usage on either side of the Atlantic; we have used those terms on which the authors (one American and one English) have reached consensus.

It has been said that all of orthopaedic surgical approaches can be reduced to one line: "Avoid cutting round structures." This book has been written to tell you how.

Stanley Hoppenfeld, M.D.
Piet deBoer, M.A., F.R.C.S.

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Introduction: Orthopaedic Surgical Technique

Surgical technique in orthopaedics varies from surgeon to surgeon; the more experienced the surgeon, the fewer instruments he uses and the simpler his technique becomes. Certain principles, however, remain constant. They are listed below as they apply to each surgical section.

The *position of the patient* is fundamental to any approach; it is always worth taking time to ensure that the patient is in the best position and that he is secured so that he cannot move during the procedure. Operating tables are well padded, but certain bony prominences—such as the head of the fibula and greater trochanter—are not. These prominences must always be padded adequately to prevent skin breakdown and nerve entrapment during surgery. Patients who are prone must have suitable padding placed under their pelvis, chest, head, and nose to allow respiration during surgery. Many different systems ensure adequate ventilation of the patient; bolsters placed longitudinally under the side of the patient are probably the best. Ventilation of the prone patient must be adequate before surgery, since repositioning of the patient during surgery is difficult and almost inevitably contaminates the sterile field.

The surgeon should be comfortable during surgery, with the patient placed at the correct height for the surgeon's size or the table low enough to allow him to operate sitting down.

In surgery on the limbs, a tourniquet is often used to create a bloodless field, making identification of vital structures easier and expediting surgery.

To apply the tourniquet, empty the limb of blood, either by elevating it for 3 to 5 minutes or by applying a soft rubber compression bandage. The tourniquet should be padded with a soft dressing to prevent the wrinkles (and blisters) that inevitably occur when the skin is pinched. The tourniquet may be applied to the upper arm or thigh. Both of these areas are well muscled; the major nerves are protected from compression of the tourniquet. The inflated pressure of the tourniquet should be about 275 mm Hg in the upper limb and 450 mm Hg in the lower limb, depending on the circumference of the limb. Test the tourniquet by inflating it *before* applying it to the patient. In children, inflate the tourniquet to 50% above their systolic pressure. In hypertensive patients, inflate it 50% more than their systolic pressure. Finally, do not leave the tourniquet inflated for longer

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