Eighth Edition

CAMPBELL'S OPERATIVE ORTHOPAEDICS

Edited by

A.H. CRENSHAW, M.D.

VOLUME TWO

VOLUME TWO

Eighth Edition

CAMPBELL'S OPERATIVE ORTHOPAEDICS

Edited by

A.H. CRENSHAW, M.D.

Editorial assistance by

KAY DAUGHERTY

Art coordination by

CHARLES CURRO

with over 7900 illustrations

Mosby Year Book

St. Louis Baltimore Boston Chicago London Philadelphia Sydney Toronto

Mosby
Year Book

Dedicated to Publishing Excellence

Editor: Eugenia A. Klein
Managing Editor: Kathryn H. Falk
Editorial assistance by: Robin Sutter and Diane Schindler
Project Manager: Gayle May Morris
Production Editors: Deborah Vogel, Sheila Walker,
Donna L. Walls, Mary Cusick Drone, and Judith Bange
Book and Cover Design: Gail Morey Hudson

EIGHTH EDITION

Printed in the United States of America

Mosby–Year Book, Inc.
11830 Westline Industrial Drive, St. Louis, Missouri 63146

Library of Congress Cataloging in Publication Data

Campbell's operative orthopaedics / edited by A.H. Crenshaw; editorial assistance by Kay Daugherty; art coordination by Charles Curro.— 8th ed.
p. cm.
Includes bibliographical references and indexes.
ISBN 0-8016-1096-6
1. Orthopedic surgery. I. Crenshaw, A.H. (Andrew Hoyt), 1920-
. II. Daugherty, Kay. III. Campbell, Willis C. (Willis Cohoon), 1880-1941. IV. Title: Operative orthopaedics.
[DNLM: 1. Orthopedics. WE 168 C1921]
RD731.C32 1991
617.3 — dc20
DNLM/DLC
for Library of Congress 91-29931
CIP

92 93 94 95 96 CL/UN/MV 9 8 7 6 5 4 3 2 1

Contributors

JAMES H. BEATY, M.D.

Chapters 42, 43, 44, and 47

Associate Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Chief, Tennessee Crippled Children's Service; Associate Chief of Pediatric Orthopaedics, LeBonheur Children's Medical Center; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis, Veterans' Administration Medical Center

JAMES H. CALANDRUCCIO, M.D.

Chapter 70

Instructor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinics, Inc., Baptist Memorial Hospitals, University of Tennessee–William F. Bowld Hospital, Veterans' Administration Hospital, LeBonnheur Children's Medical Center

S. TERRY CANALE, M.D.

Chapters 26, 32, and 40

Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Chief of Pediatric Orthopaedics, LeBonnheur Children's Medical Center; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospital; Consultant Staff, Regional Medical Center at Memphis, Veterans' Administration Medical Center

PETER G. CARNESALE, M.D.

Chapters 7 through 12

Clinical Associate Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Chief of Orthopaedics, Veterans' Administration Medical Center; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospital, Regional Medical Center at Memphis; Consultant Staff, LeBonheur Children's Medical Center, St. Joseph Hospital, St. Jude Children's Research Hospital, Methodist Hospitals

A.H. CRENSHAW, M.D.

Chapter 1

Clinical Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Emeritus Staff, Campbell Clinic, Inc.

ANDREW H. CRENSHAW, JR., M.D.

Chapters 2, 25, and 34

Assistant Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis, Veterans' Administration Medical Center; Associate Staff, LeBonnheur Children's Medical Center; Consultant Staff, University of Tennessee–William F. Bowld Hospital; Courtesy Staff, Baptist Memorial Hospital–Germantown

JOSEPH P. DUTKOWSKY, M.D.

Chapter 41

Assistant Professor and Director of Laboratory Research, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, University of Tennessee–William F. Bowld Hospital, LeBonheur Children's Medical Center, Regional Medical Center at Memphis, Veterans' Administration Hospital, Baptist Memorial Hospitals; Consultant Staff, St. Jude Children's Research Hospital, St. Joseph Hospital

ALLEN S. EDMONSON, M.D.

Chapters 81 and 82

Clinical Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery; Assistant Dean, University of Tennessee, Memphis; Director of Graduate Medical Education, Baptist Memorial Hospital; Active Staff, Campbell Clinic, Inc., Regional Medical Center at Memphis; Consultant Staff, Methodist Hospital, St. Francis Hospital, St. Joseph Hospital, Veterans' Administration Medical Center; LeBonheur Children's Medical Center

BARNEY L. FREEMAN III, M.D.

Chapters 30, 31, and 83

Clinical Associate Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis; Consultant Staff, LeBonheur Children's Medical Center, Methodist Hospital, Germantown Community Hospital–Methodist Hospital East, St. Francis Hospital, Veterans' Administration Medical Center

STANLEY C. GRAVES, M.D.

Chapter 58

Instructor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, University of Tennessee–William F. Bowld Hospital, Regional Medical Center at Memphis

JAMES W. HARKESS, M.D.

Chapters 14 and 16

Assistant Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Regional Medical Center at Memphis, University of Tennessee–William F. Bowld Hospital, LeBonheur Children's Medical Center, Veterans' Administration Medical Center, Baptist Memorial Hospitals

MARK T. JOBE, M.D.

Chapters 45, 49, 69, 70, 71, 73, 74, 75, and 77

Instructor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, University of Tennessee–William F. Bowld Hospital, Regional Medical Center at Memphis, LeBonheur Children's Medical Center, Veterans' Administration Medical Center

E. JEFF JUSTIS, JR., M.D.

Chapters 13 and 64

Clinical Associate Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospital, Regional Medical Center at Memphis; Consultant Staff, Arlington Developmental Center, LeBonheur Children's Medical Center, Veterans' Administration Medical Center; Courtesy Staff, Methodist Hospital; Consultant to the Surgeon General, United States Air Force; Consultant Staff in Hand Surgery, Mississippi and Tennessee Crippled Children's Services

DAVID G. LAVELLE, M.D.

Chapter 29

Assistant Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospials, Regional Medical Center at Memphis, University of Tennessee–William F. Bowld Hospital; Consultant Staff, LeBonheur Children's Medical Center, Veterans' Administration Medical Center

MARVIN R. LEVENTHAL, M.D.

Chapters 79 and 80

Assistant Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis, LeBonheur Children's Medical Center, University of Tennessee–William F. Bowld Hospital; Consultant Staff, Veterans' Administration Medical Center

LEE W. MILFORD, M.D.

Chapter 69

Clinical Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Emeritus Staff, Campbell Clinic, Inc.

ROBERT H. MILLER III, M.D.

Chapters 35, 36, and 37

Assistant Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis, University of Tennessee–William F. Bowld Hospital, Veterans' Administration Medical Center

BARRY B. PHILLIPS, M.D.

Chapters 38 and 39

Instructor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis; Courtesy Staff, LeBonheur Children's Medical Center

E. GREER RICHARDSON, M.D.

Chapters 50 through 60

Associate Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis; Consultant Staff, University of Tennessee–William F. Bowld Hospital, Veterans' Administration Medical Center; Courtesy Staff, LeBonheur Children's Medical Center

THOMAS A. RUSSELL, M.D.

Chapters 22, 24, and 27

Associate Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis, University of Tennessee–William F. Bowld Hospital; Consultant Staff, Veterans' Administration Medical Center, LeBonheur Children's Medical Center

FRED P. SAGE, M.D.

Chapters 46 and 48

Clinical Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis, LeBonheur Children's Medical Center, Methodist Hospitals

T. DAVID SISK, M.D.

Chapters 17 and 33

Professor and Acting Chairman, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, LeBonheur Children's Medical Center, Methodist Hospitals, Regional Medical Center at Memphis, University of Tennessee–William F. Bowld Hospital

J. CHARLES TAYLOR, M.D.

Chapters 23 and 28

Assistant Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis, University of Tennessee–William F. Bowld Hospital, LeBonheur Children's Medical Center, Veterans' Administration Medical Center

ROBERT E. TOOMS, M.D.

Chapters 14, 15, 18, 19, 20, and 21

Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Chief of Staff, Campbell Clinic, Inc.; Active Staff, Baptist Memorial Hospitals, LeBonheur Children's Medical Center, Regional Medical Center at Memphis; Medical Director, University of Tennessee Rehabilitation Engineering Center; Medical Director, Regional Spinal Cord Center; Chief, Memphis Child Amputee Clinic and St. Jude Children's Research Hospital Amputee Clinic

WILLIAM C. WARNER, JR., M.D.

Chapters 3 through 6

Instructor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Chief, Mississippi Crippled Children's Service; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, LeBonheur Children's Medical Center, Veterans' Administration Medical Center, University of Tennessee–William F. Bowld Hospital

GEORGE W. WOOD II, M.D.

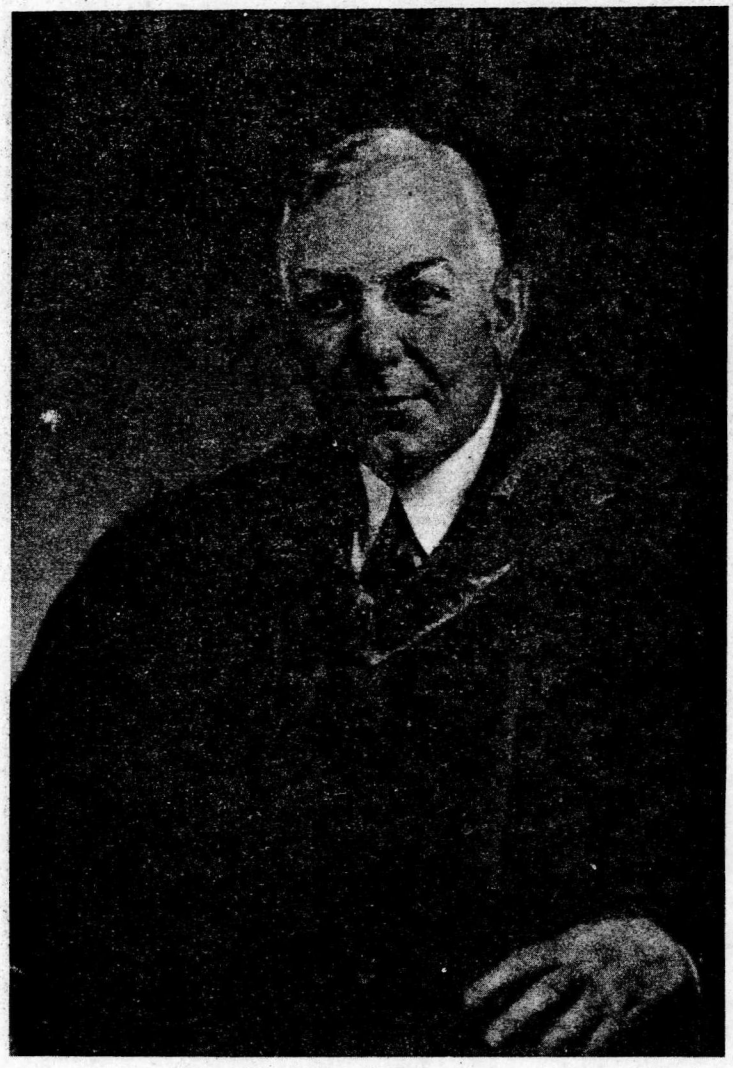
Chapters 84, 85, and 86

Clinical Associate Professor, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, Regional Medical Center at Memphis; Consultant Staff, LeBonheur Children's Medical Center, Veteran's Administration Medical Center, University of Tennessee–William F. Bowld Hospital

PHILLIP E. WRIGHT II, M.D.

Chapters 17, 45, 49, 61, 62, 63, 65, 66, 67, 68, 72, 74, 76, and 78

Associate Professor, Director of Hand Fellowship, and Director of Orthopaedic Microsurgery, University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery, University of Tennessee, Memphis; Chief of Hand Surgery Service, Regional Medical Center at Memphis; Active Staff, Campbell Clinic, Inc., Baptist Memorial Hospitals, University of Tennessee–William F. Bowld Hospital, Veterans' Administration Medical Center



WILLIS C. CAMPBELL, M.D.

1880-1941

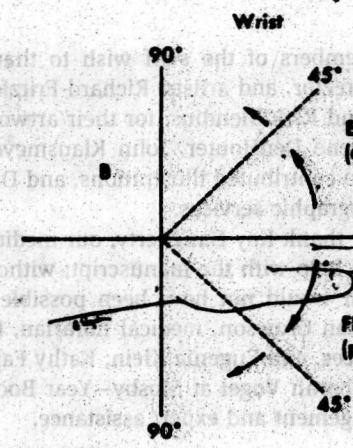
Preface to Eighth Edition

Many new methods and techniques in orthopaedic surgery have been developed or refined during the last 5 to 6 years; those of importance to practicing orthopaedic surgeons are included in this eighth edition.

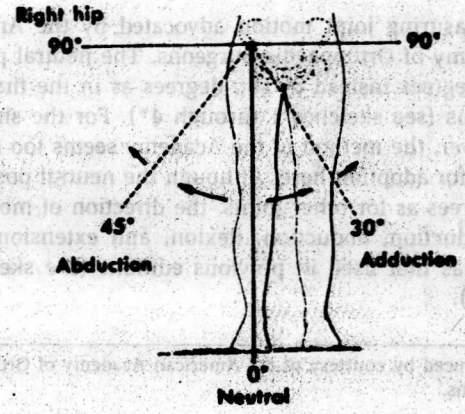
All chapters have been revised and brought up-to-date. All are written by members of the staff of the Campbell Clinic. Several authors, some new to this edition, have had much experience in a busy, Level 1 trauma center, and this experience is reflected in the discussions on fresh fractures, delayed unions, nonunions, microsurgery, and other subjects.

The format of this edition is essentially the same as for the last edition. The discussions on the foot have been expanded into 11 chapters and on the hand into 18. A total of 86 chapters have been grouped into 18 parts for better presentation. Over 2300 illustrations are new or totally redrawn.

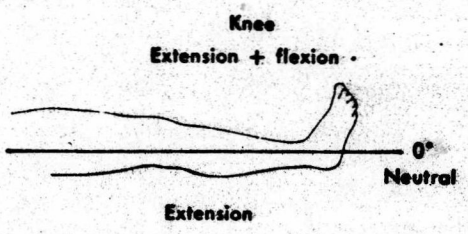
We have continued to use almost entirely the method

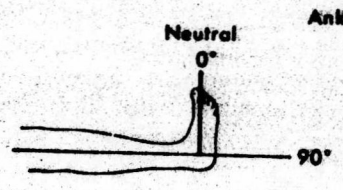


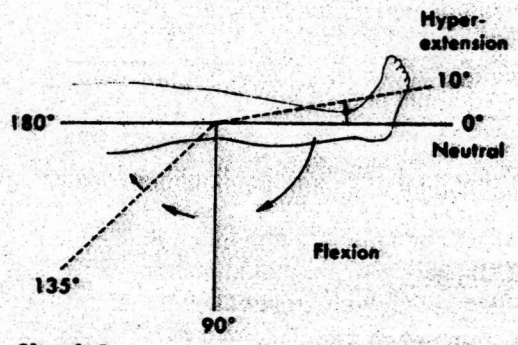
Sketch 1



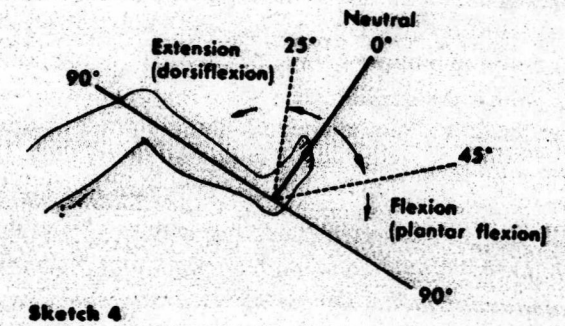
Sketch 2



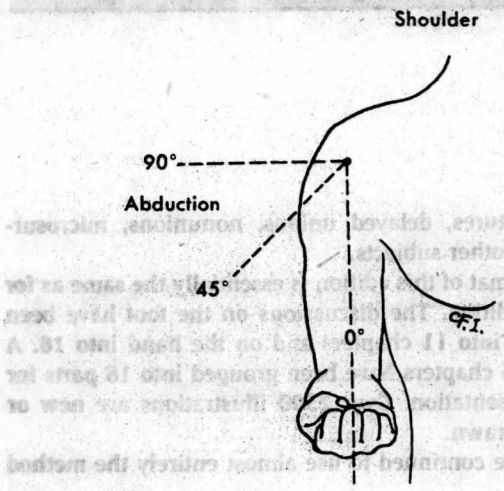




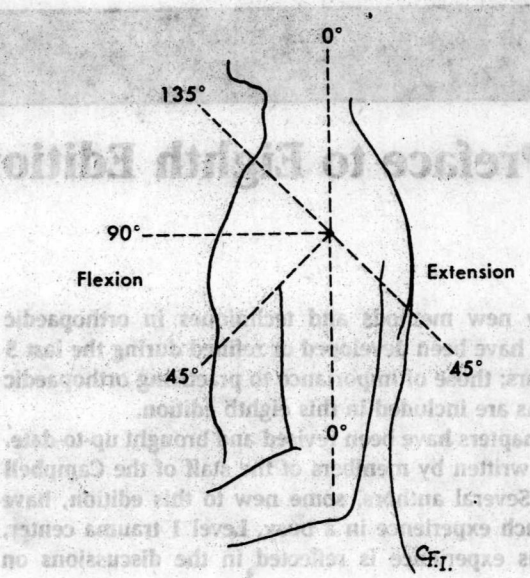
Sketch 3



Sketch 4



Sketch 5



Sketch 6

of measuring joint motion advocated by the American Academy of Orthopaedic Surgeons. The neutral position is 0 degrees instead of 180 degrees as in the first three editions (see sketches 1 through 4*). For the shoulder, however, the method of the Academy seems too complicated for adoption here. Although the neutral position is 0 degrees as for other joints, the direction of movement in adduction, abduction, flexion, and extension is the same as that used in previous editions (see sketches 5 and 6).

Reproduced by courtesy of the American Academy of Orthopaedic Surgeons.

The editor and members of the staff wish to thank Charlie Curro, Art Director, and artists, Richard Fritzler, Sarah C. McQueen, and Rick Mendius, for their artwork for this edition. Marlene DenHouter, John Klausmeyer, and Mary Stewart also contributed illustrations, and Dan Ralph provided photographic services.

I wish to especially thank Kay Daugherty, our medical editor, for her skillful help with the manuscript; without her help this revision would not have been possible. I wish also to thank Joan Crowson, medical librarian, for her help with references, and Eugenia Klein, Kathy Falk, Robin Sutter, and Deborah Vogel at Mosby–Year Book, Inc. for their encouragement and expert assistance.

A.H. Crenshaw, M.D.

Preface to First Edition

The title of this book, *Operative Orthopedics*, is not intended to convey the impression that the chief or most important method of treatment of orthopaedic affections is open surgery. Although many orthopaedic affections are best treated by operative measures alone, the majority are successfully treated by more conservative means. Further, such measures are often essential adjuncts either before or after operation.

This volume has been written to meet the current need for a comprehensive work on operative orthopedics, not only for the specialist, but also for many industrial and general surgeons who are doing excellent work in some branches of orthopedic surgery, and are making valuable contributions to this field.

The evolution of orthopedic surgery has been exceedingly slow as compared to that of surgery in general. Not until aseptic technic had been materially refined was surgery of the bones and joints feasible. The statement is often made that the World War afforded the experience which made possible the rapid development or orthopedic surgery during the past two decades. The surgery of the war, however, was chiefly the surgery of sepsis; there was little of the refined asepsis which is required in reconstruction surgery. Undoubtedly, the demonstration during the war of the necessity and importance of this field led many able men to specialize in orthopedics, and to them considerable credit is due for its subsequent progress.

No classification of orthopedic affections is entirely satisfactory; consequently, any arrangement of operative procedures is subject to similar criticism. With the exception of the chapters on Arthroplasty and Arthrodesis, operations described in this text are grouped together according to their applicability to a given affection. This involves less repetition as to generalities of etiology, pathology, and treatment than would be necessary in a classification according to anatomic location. Operative procedures appropriate to two or more affections are described in the discussion of the one wherein they are most commonly employed.

To overcome the too widespread conception of orthopedic surgery as a purely mechanical equation, an effort is made in the first chapter of this book to correlate the mechanical, surgical, and physiologic principles of orthopedic practice, and throughout the book to emphasize the practical application of these physiologic principles. A special chapter has been written on surgical technic, for the purpose of stressing certain details in preparation and aftertreatment which vary to some extent from those described in works on general surgery. A thorough knowledge of these phases of treatment is a requisite to success. To avoid constant repetition, chapters have been included on apparatus and on surgical approaches; repeated reference is made to these chapters. The aftertreatment is given in detail for practically all operative technics. This is a most essential, yet too often neglected, factor in the success of any surgical treatment.

In giving the position or range of motion of a joint, only one system has been followed: with the exception of the ankle and wrist, the joint is in neutral position when parallel with the long axis of the body in the anteroposterior and lateral planes. As the joint proceeds from the neutral position in any direction, the number of degrees in which such movement is recorded decreases progressively from 180 to 170, 160, and so on, to the anatomic limit of motion in that particular direction. To illustrate, complete extension of the knee is 180 degrees; when the joint is flexed 30 degrees, the position is recorded as the angle formed between the component parts of the joint, i.e., the leg and thigh, or 150 degrees. Flexion to a right angle is 90 degrees, and full flexion 30 degrees. In the wrist, the joint is at 180 degrees, or in the neutral position, when midway between supination and pronation, and flexion and extension. In the ankle joint, motion is recorded as follows: the extreme of dorsiflexion, 75 degrees; right angle, 90 degrees; and the extreme of plantar flexion, 140 degrees.

In some instances, the exact end results have been given, to the best of our knowledge. So many factors are involved in any one condition, that a survey of end results can be of only questionable value unless the minute details of each case are considered. Following arthroplasty of the knee, for example, one must consider the etiology, pathology, position of the ankylosed joint, the structure of the bones comprising the joint, the distribution of the ankylosis, and the age of the patient, in estimating the end result in each case. Further, a true survey should include the results of *all* patients treated over a period of *many* years, and should be made by the surgeon himself, rather than by a group of assistants, or by correspondence.

In our private clinic and the hospitals with which we are associated, a sufficient amount of material on every phase of orthopedic surgery has been accumulated dur-

ing the past twenty years or more to justify an evaluation of the various procedures. From this personal experience, we also feel that definite conclusions may be drawn in regard to the indications, contraindications, complications, and other considerations entering into orthopedic treatment. In all surgical cases, mature judgment is required for the selection of the most appropriate procedure. With this in mind, the technics which have proved most efficient in the author's experience have been given preference in the text. In addition, after a comprehensive search of the literature, operative measures have been selected which in the judgment of the author are most practicable.

Although no attempt has been made to produce an atlas of orthopedic surgery, an effort has been made to describe those procedures which conform to mechanical and physiologic principles and will meet all individual requirements. In any work of this nature, there are sins of omission; also, many surgeons in the same field may arrive independently at the same conclusions and devise identical procedures. We have endeavored, however, to give credit where credit was due. If there are errors, correction will gladly be made. In some of the chapters we have drawn heavily from authoritative articles on special subjects; the author gratefully acknowledges his indebtedness for this material. He also wishes to thank those authors who have so graciously granted permission for the reproduction of original drawings.

In conclusion, I cannot too deeply express my sincere appreciation and gratitude to my associate, Dr. Hugh Smith, who has untiringly and most efficiently devoted practically all of his time during the past two years to collaboration with me in the compilation and preparation of material, which alone has made this work possible. I also desire to express appreciation to Dr. J.S. Speed for his collaboration on the sections on Spastic Cerebral Paralysis and Peripheral Nerve Injuries to Dr. Harold Boyd for anatomic dissections verifying all surgical approaches described, and for his assistance in preparing the chapter on this subject; to Dr. Don Slocum for his aid in the preparation of the chapter on Physiology and Pathology; to Mrs. Allene Jefferson for her efficient editorial services, and to Mr. Ivan Summers and Mr. Charles Ingram for their excellent illustrations.

Willis C. Campbell
1939

Contents

Color Plates

PART VI

AMPUTATIONS

CHAPTER 18

General Principles of Amputations

ROBERT E. TOOMS

Amputation is the most ancient of all surgical procedures. Amputation of a hand or foot was a common punishment in many of the older so-called civilized societies and is still carried out today in some primitive cultures. The early wars like all others resulted in many amputations. Archeological evidence indicates that even among prehistoric people there were a few with amputations, including those born with skeletal limb deficiencies and those surviving loss of limbs from trauma.

Early surgical amputation was a crude procedure by which a limb was rapidly severed from an unanesthetized patient; for hemostasis the open stump was crushed or was dipped in boiling oil. Obviously these amputation stumps were poorly suited for fitting even with the unrefined prostheses then available. Early in the sixteenth century amputation surgery and prosthetics were much improved by Ambroise Paré, a French military surgeon. Paré created more functional stumps and was the first to use ligatures to control bleeding after amputation; he also designed relatively sophisticated prostheses. Amputation surgery was further improved by Morel's introduction of the tourniquet in the seventeenth century. With the development of anesthesia and aseptic technique surgeons for the first time could carefully fashion sturdy and functional amputation stumps and could reasonably anticipate healing of the wound without infection. Interest in amputation surgery and prosthetics increased in the United States after World War I, but this interest soon waned because the number of people with amputations in this country was relatively small and because the economy became severely depressed. After World War II interest again increased and new surgical techniques and better prostheses were devised for the many who lost limbs as a result of the war.

Interest in prosthetic design and development was further stimulated by the Committee on Prosthetic Research and Development of the National Academy of Sciences until the lamentable demise of the organization. The prosthetic research and rehabilitation engineering centers supported by the federal government continue to design, develop, and evaluate new prosthetic components and techniques, and new information on biomechanics and prosthetics is disseminated by the several university prosthetics education programs charged with this responsibility. In the past two decades there has been increased interest in improving surgical techniques and care after surgery, stimulated initially by the technique of immediate postsurgical prosthetic fitting. Despite these positive activities the destructive nature of amputation often results in a defeatist attitude in which the surgeon considers the operation an undesirable although necessary chore to be performed as rapidly as possible. Furthermore, amputations are often performed by surgeons with little knowledge of or interest in amputee rehabilitation. Amputation of an irreparably damaged or diseased limb is actually the first step in returning the patient to a normal and productive place in society; therefore the operation should be planned and performed with the same care and skill used in plastic and reconstructive operations, and rehabilitation should be supervised by experts. The development of immediate and early postsurgical prosthetic fitting has stimulated many improvements in amputation surgery; more physiologic surgical techniques have developed, and research into the basic bio-

logic and biomechanical functions of the amputation stump has been encouraged. Of even more importance, perhaps, has been the impact of immediate postsurgical prosthetic fitting on the attitude of the surgeon, who has become more aware of his responsibility in patient care immediately after surgery and in rehabilitation. As R.G. Thompson stated, "removing the sutures should not imply transfer of the patient from the surgeon's care."

INCIDENCE OF AMPUTATION

In the proper sense amputation is a procedure that removes a part through one or more bones and should be distinguished from disarticulation that removes a part through a joint. For simplicity in this discussion, however, the term "amputation" is applied to both procedures. Furthermore, surgical rather than congenital amputations are considered here. Congenital limb deficiencies are discussed in Part XIII; see Congenital anomalies, Chapters 42 through 44.

Accurate statistics concerning the current incidence and prevalence of limb loss in the United States are not readily available. Published estimates vary significantly, citing prevalences from 350,000 to over 1 million amputees and incidences from 20,000 to 30,000 new amputees each year. However, most reports agree that the number of amputations performed increases each year. This is primarily the result of an aging population with a high incidence of diabetes and peripheral vascular disease. Chronologically, the highest incidence of limb loss occurs in the 50- to 75-year age group and is mainly related to vascular disease with or without diabetes. In younger adults amputation is most often the result of injury or its sequelae. In children, limb deficiency is congenital in 60% of cases; acquired amputations are usually incurred because of injury or as a treatment for malignancy.

About 75% of all new amputees are men; vocational and avocational hazards are greater for men than for women, and amputations because of disease are more common in men. Approximately 85% of all amputations are through the lower limbs, but the number of amputations of right and left limbs is about equal.

INDICATIONS FOR AMPUTATION

Irreparable loss of the blood supply of a diseased or injured limb is the only absolute indication for amputation regardless of all other circumstances. A part cannot survive when its means of nutrition is destroyed; it then becomes not only useless but a menace to life because the toxic products of tissue destruction are spread throughout the body. Often an injury not affecting the circulation in a limb is otherwise so severe that function cannot be restored or function would be better after amputation and the fitting of a prosthesis. Sometimes amputation is necessary to save life when infection in a limb is uncontrollable. Many malignant tumors are best treated by amputation for obvious reasons. Occasionally amputation is indicated to remove part or all of a congenitally abnormal limb to improve function with or without a prosthesis. These are the general indications for amputation; each will be considered in more detail.

Peripheral Vascular Disease

Most amputations are performed for peripheral vascular disease, whether arteriosclerotic, arteriosclerotic with diabetes mellitus, or some other type. This indication is more common in elderly people because both diabetes mellitus and vascular diseases are more common in this age group.

Gangrene of a limb caused by arteriosclerosis is usually more difficult to treat in the presence of diabetes mellitus because the tissues heal poorly and are more susceptible to infection in diabetic patients. Furthermore, diabetic neuropathy, even when subclinical, can cause delayed healing when diminished sensation results in repeated but unnoticed injuries. Arteriosclerosis and diabetes mellitus are systemic diseases, and this fact should be considered when amputations are necessary in these diseases. The status of the heart, kidneys, and cerebral circulation should be evaluated before surgery, and any systemic infection should be actively treated.

During the past two decades it has been shown repeatedly that after amputations through the lower extremity for peripheral vascular disease, either with or without diabetes mellitus, the stump will usually heal even when the level of amputation is below the knee, but any infection must be carefully controlled before surgery, nutritional status must be optimal, the surgical technique must be meticulous, and the management after surgery must be proper. Immediate and early postsurgical prosthetic-fitting techniques have been extremely valuable in peripheral vascular disease: they benefit the tissues locally and allow elderly patients to walk soon after surgery. Preserving the knee joint is quite important in rehabilitation because many of these patients are weak, have poor balance, and have disease in the opposite lower limb.

Injury

The second most common indication for amputation is injury, and in adults under 50 years of age injury is probably the chief indication. Injuries requiring amputation occur more often in men and more often in the lower limbs. An acute injury is an indication for amputation when the blood supply of a limb is irreparably destroyed or when the limb is so severely damaged that reasonable reconstruction is impossible.

Today we have widely available microsurgical tech-