DuVries' SURGERY OF THE FOOT

EDITOR
ROGER A. MANN

FOURTH EDITION

DuVries' SURGERY OF THE FOOT

EDITOR
ROGER A. MANN, M.D.

Associate Clinical Professor, Department of
Orthopaedic Surgery, University of California School of Medicine;
Director, Gait Analysis Laboratory, Shriner's Hospital
for Crippled Children, San Francisco;
Chief, Foot Surgery, Children's Hospital of the
East Bay and Samuel Merritt Hospital;
Consultant, Foot Surgery, Oak Knoll Naval Hospital,
Oakland, California

FOURTH EDITION
with **936** illustrations

The C. V. Mosby Company
Saint Louis 1978

FOURTH EDITION

Printed in the United States of America

The C. V. Mosby Company
11830 Westline Industrial Drive, St. Louis, Missouri 63141

Library of Congress Cataloging in Publication Data

DuVries, Henri L
DuVries' Surgery of the foot.

Bibliography: p.
Includes index.
1. Foot—Surgery. I. Mann, Roger A., 1936-
II. Title. III. Title: Surgery of the foot.
[DNLM: 1. Foot—Surgery. WE880 D987s]
RD563.D94 1978 617'.585 78-10829
ISBN 0-8016-2333-2

TS/CB/B 9 8 7 6 5 4 3 2 1

DuVries' SURGERY OF THE FOOT

Contributors

Donald E. Baxter, M.D.

Assistant Clinical Professor of Orthopaedic Surgery and Chief, Foot Surgery Clinic, University of Texas at Houston; Assistant Surgeon, Shriner's Hospital for Crippled Children; Consultant in Foot Surgery, Veterans Administration Hospital; Assistant Clinical Professor of Orthopedic Surgery, Baylor College of Medicine, Houston, Texas

Michael W. Chapman, M.D.

Associate Professor of Orthopaedic Surgery, University of California School of Medicine, San Francisco, California

Igor Z. Drobocky, M.D.

Staff Diagnostic Radiologist, Doctors' Hospital, San Leandro, and Laurel Grove Hospital in Castro Valley; Consultant Radiologist, U.S. Navy, Oakland Naval Hospital, Oakland, California

Henri L. DuVries, M.D., D.P.M.

Assistant Clinical Professor of Orthopaedic Surgery (retired), University of California School of Medicine; Clinical Professor of Surgery, California College of Podiatric Medicine, San Francisco; Member, Senior Surgical Staff, Samuel Merritt Hospital, Oakland, California

Earl N. Feiwell, M.D.

Chief Orthopaedic Surgeon, Myelodysplasia Team, Rancho Los Amigos Hospital, Downey; Instructor of Orthopaedic Surgery, University of Southern California School of Medicine, Los Angeles, California

Douglas E. Garland, M.D.

Chief, Problem Fracture Service, Rancho Los Amigos Hospital, Downey, California

James M. Glick, M.D.

Assistant Clinical Professor of Orthopaedic Surgery, University of California School of Medicine; Associate Professor of Physical Education and Team Physician, San Francisco State University; Team Physician, City College of San Francisco, San Francisco, California

M. Mark Hoffer, M.D.

Chief of Children's Orthopaedic Service, Rancho Los Amigos Hospital, Downey, California

John D. Hsu, M.D., C.M.

Assistant Professor, Department of Surgery (Orthopaedics), University of Southern California School of Medicine; Director, M.D.A.A. Clinic, Orthopaedic Hospital, Los Angeles; Attending Orthopaedic Surgeon and Chief, Muscle Disease Clinics, Rancho Los Amigos Hospital, Downey, California

Walter W. Huurman, M.D.

Assistant Professor, Department of Orthopaedic Surgery and Rehabilitation; Assistant Professor, Department of Pediatrics, and Head, Division of Pediatric Orthopaedics, The University of Nebraska Medical Center, Omaha, Nebraska

Verne T. Inman, M.D., Ph.D.

Professor of Orthopaedic Surgery and Director, Biomechanics Laboratory (Emeritus), University of California School of Medicine, San Francisco, California

James O. Johnston, M.D.

Chief of Orthopaedics, Kaiser Hospital, Oakland; Associate Clinical Professor of Orthopaedics, University of California School of Medicine, San Francisco, California

Roger A. Mann, M.D.

Associate Clinical Professor, Department of Orthopaedic Surgery, University of California School of Medicine; Director, Gait Analysis Laboratory, Shriner's Hospital for Crippled Children, San Francisco; Chief, Foot Surgery, Children's Hospital of the East Bay and Samuel Merritt Hospital; Consultant, Foot Surgery, Oak Knoll Naval Hospital, Oakland, California

Stanford F. Pollock, M.D.

Assistant Clinical Professor of Orthopaedic Surgery, University of California School of Medicine; Research Associate, Veterans Administration Hospital, San Francisco; Active Staff, Mills Memorial Hospital, San Mateo, California

Jerral S. Seibert, M.D.

Associate Clinical Professor of Dermatology, University of California School of Medicine, San Francisco; Chief Physician of Dermatology, Samuel Merritt Hospital; Chief, Dermatology Service, Providence Hospital, Oakland, California

F. William Wagner, Jr., M.D.

Associate Clinical Professor, Orthopaedic Surgery, University of Southern California School of Medicine, Los Angeles; Co-Director, Orthopaedic Diabetic Service, Rancho Los Amigos Hospital, Downey, California

Robert L. Waters, M.D.

Chief, Surgical Services, and Chief, Stroke Service, Rancho Los Amigos Hospital, Downey, California

To

my parents

for the opportunities presented to me

To

my wife and family

for their patience and understanding

PREFATORY NOTE TO FOURTH EDITION

I am deeply indebted to my associate, Dr. Roger A. Mann, for his diligent editing and his original contributions to this edition and to the second and third editions. I am also extremely grateful to my many other colleagues who submitted new chapters.

It has been very gratifying to observe the tremendous interest and progress the healing arts have made in recent years in both the care and the knowledge of the diseases and deformities of the human foot—disorders that, although they have comprised a most common human ailment, have been practically ignored in the past. This marked advancement is evidenced within the fields of orthopaedic surgery and podiatry.

Henri L. DuVries, M.D., D.P.M.
Oakland, California

Foreword

In an energy era it has been easy to overlook basic forms and sources of locomotion, yet their contribution is constantly being reasserted. Our foot, to a degree, has somewhat similarly suffered. We require reexamination of anatomical and physiological fundamentals to interpret reactions to new stresses. We have not ever been standing on the same type of terrain over the centuries as we are now, moss to resilient cork, natural to artificial turf; the present gamut brings to mind examples which are likely to proliferate profoundly.

Structural interplay has emerged as the dominant influence in evaluating regional disorders in the body. The role of the foot in increased speed of ambulation, running, now must be assimilated for accurate identification of limb impairment in the huge field of athletic disorders. The greatly increased intrusion of artificial elements, now of established acceptance, to provide artificial joints is a modern miracle we need to grow with.

Such principles have been interpreted, and solutions presented, in this text as an up-to-date aid in treating the increasingly broad field of foot disorders. The book represents a distillation of new clinical syndromes, experience, conservative and practical aids, and appropriate surgical solutions, which combination should facilitate immensely its use by physician, surgeon, and all paramedical personnel.

James E. Bateman, M.D., F.R.C.S.(C)

Surgeon-in-Chief,
Orthopaedic and Arthritic Hospital,
Toronto, Ontario

Preface

It has been twenty years since the first edition of DuVries' *Surgery of the Foot* appeared. At the time of the first writing, Dr. Henri DuVries had thirty years' experience in the treatment of foot problems. I am glad to say that he is still going strong twenty years later. I was greatly honored to be asked to edit the fourth edition of this book, which from its inception has been one of the mainstays of knowledge regarding the function, diagnosis, and treatment of conditions of the foot and ankle.

My interest in the foot began in my second year of medical school, and after listening to the stimulating biomechanics lectures of Verne T. Inman, editor of the third edition, I became interested in the lower extremity, especially the foot. My first year of orthopaedic residency was spent with Verne Inman in the Biomechanics Laboratory at the University of California Medical Center in San Francisco, studying human gait and particularly the intrinsic muscles of the foot.

In my second year of residency, I met Henri DuVries, who as consultant to the Foot Clinic taught me how to evaluate and treat problems of the foot. After my orthopaedic residency I spent a year of fellowship with Dr. DuVries furthering my knowledge about the clinical aspects of the foot. It was during this year of fellowship that I realized that, although Dr. DuVries did not possess the biomechanical background of Dr. Inman nor Dr. Inman the clinical background of Dr. DuVries, I had been placed in the unique position of bringing together the basic principles advocated by these two brilliant men. Working together with these men in the past fifteen years has given me the basic biomechanical and clinical knowledge I needed to approach and treat patients with foot problems. It is with this background that I approached the task as editor of the fourth edition.

The first edition of *Surgery of the Foot* was the labor of Henri DuVries, who presented to the medical world his vast clinical experience in foot problems. In the second edition he included other contributors to help expand specific sections of the book. The third edition, edited by Dr. Inman, changed the basic format of the book to include the ankle joint and expanded the number of contributors to specific sections.

As editor of the fourth edition, I have obtained contributors who have shown a specific interest in the topic they present. Thus the discussions on children's feet, neuromuscular diseases, the diabetic foot, dermatology, pathology, and radiology have been extensively rewritten. In the sections previously written by Dr. DuVries, I have attempted to reorganize the material to specifically indicate the etiology, pathophysiology, and various methods of treatment. I have also pointed out the surgical techniques that Dr. DuVries and I consider to be the procedures of choice for specific foot problems.

Needless to say, even after four editions, I still feel that further changes will become necessary as medicine continues to progress but the principles presented throughout this book are basic in their approach and will not change significantly over the years.

Roger A. Mann

Contents

PART ONE

Basic considerations

1

BIOMECHANICS OF THE FOOT AND ANKLE

Verne T. Inman and Roger A. Mann

The initial chapters of this text on surgery will be concerned not with anatomy, as is customary, but with a discussion of the biomechanics of the foot and ankle. The specific relationships will be emphasized and some methods for functional evaluation of the foot will be presented. These alterations were initiated for several reasons.

First, it has been assumed that the orthopaedic surgeon possesses an accurate knowledge of the anatomic aspects of the foot and ankle. If this knowledge is lacking, textbooks of anatomy are available that depict in detail the precise anatomic structures comprising this part of the human body. It seems redundant to devote space here to what can only be a superficial review of the anatomy of the foot and ankle.

Second, it seems mandatory that any textbook on surgery of the foot should begin with a discussion of the biomechanics of the foot and ankle as an integral part of the locomotor system. The human foot is an intricate mechanism that functions interdependently with other components of the locomotor system. No text is readily available to the surgeon that clearly enunciates the functional interrelationships of the various parts of the foot. Interference with the functioning of a single part may be reflected in altered functions of the remaining parts. Yet the surgeon is constantly called upon to change the anatomic and structural components of the foot. When so doing, he should be fully aware of the possible consequences of his actions.

Third, wide variations are known to occur in the component parts of the foot and ankle, and these variations are reflected in the degree of contribution of each part to the behavior of the entire foot. Depending on the contributions of an individual component, the loss or functional modification of that component by surgical intervention may result in either minimal or major alterations in the functional behavior of adjacent components. An understanding of basic interrelationships may assist the surgeon in explaining to himself why the same procedure performed on the foot of one person produced a satisfactory result while in another person the result was unsatisfactory.

Fourth, by being alert to the mechanical behavior of the foot, the physician may find that some foot disabilities caused by malfunction of a component part can be successfully treated by nonsurgical procedures rather than attacked surgically as has been customary. Furthermore, some operative procedures that fail to achieve completely the desired result can be further improved by minor alterations in the behavior of adjacent components through shoe modification or the use of

inserts. An understanding of the biomechanics of the foot and ankle should, therefore, be an essential aid in surgical decision making and contribute to the success of postoperative treatment.

LOCOMOTOR SYSTEM

The human foot is too often viewed as a semirigid base whose principal function is to provide a stable support for the superincumbent body. In reality the foot is poorly designed for this purpose. Standing for prolonged periods of time can result in a feeling of fatigue or can produce actual discomfort in the feet. One always prefers to sit rather than stand. Furthermore, it is far less tiring to walk, run, jump, or dance on normally functioning feet—either barefooted or in comfortable shoes—than it is to stand. The foot, therefore, appears to have evolved as a dynamic mechanism functioning as an integral part of the locomotor system and should be studied as such rather than as a static structure designed exclusively for support.

Since human locomotion involves all major segments of the body, obviously certain suprapedal movements demand specific functions from the foot and alterations in these movements from above may be reflected below by changes in the behavior of the foot. Likewise, the manner in which the foot functions may be reflected in patterns of movement in the other segments of the body. Therefore the basic functional interrelationships between the foot and the remainder of the locomotor apparatus must be clearly understood.

To begin a review of the locomotor system, one must recognize that ambulating man is both a physical machine and a biologic organism. The former makes him subject to the physical laws of motion, the latter to the laws of muscular action. All characteristics of muscular behavior are exploited in locomotion; for example, when called upon to perform such external work as initiating or accelerating angular motion around joints, muscles rarely contract at lengths below their resting lengths (Bresler and Berry, 1951; Ryker, 1952; Close and Inman, 1953). When motion in the skeletal segments is decelerated or when external forces work upon the body, activated muscles become efficient. Activated muscles, in fact, are approximately six times as efficient when resisting elongation as when shortening to perform external work (Abbott et al., 1952; Asmussen, 1953; Banister and Brown, 1968). In addition, noncontractile elements in muscles and specific connective tissue structures assist muscular action. Thus human locomotion is a blending of physical and biologic forces which compromise to achieve maximal efficiency at minimal cost.

Man uses a unique and characteristic orthograde bipedal mode of locomotion. This method of locomotion imposes gross similarities in the manner in which all of us walk. However, each of us exhibits minor individual differences that permit us to recognize a friend or acquaintance even when he is viewed from a distance. The causes of these individual characteristics of locomotion are many. Each of us differs somewhat in the length and distribution of mass of the various segments of the body—segments that must be moved by muscles of varying fiber lengths. Furthermore, individual differences occur in the position of axes of movement of the joints, with concomitant variations in effective lever arms. Such factors as these and many more combine to establish in each of us a final idiosyncratic manner of locomotion.

A smoothly performing locomotor system results from the harmonious integration of many components. This final integration does not require that the specific contribution of a single isolated component be identical in every individual, nor must it even be identical within the same individual. The contribution of a single component varies under different circumstances. Type of shoe, amount of fatigue, weight of load carried, and other such variables can cause diminished functioning of some components with compensatory increased functioning of others. An enormous number of variations in the behavior of individual components is possible; however, the diversely functioning components, when integrated, are found to be complementary and will produce smooth bodily progression.