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RockWood and Green's Fractures in Adults

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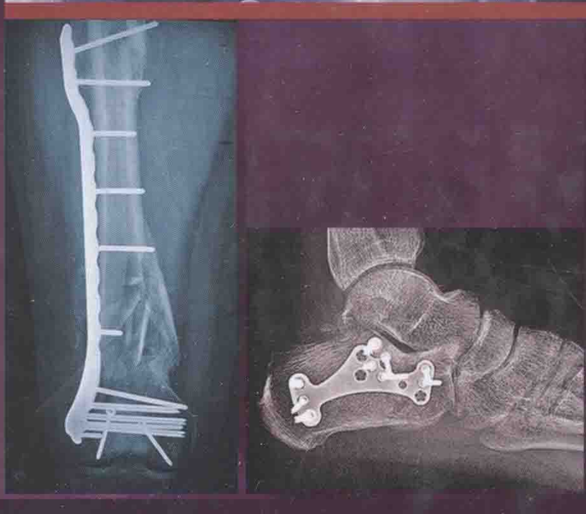
洛克伍德-格林 成人骨折

第8版

第1卷



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Wolters Kluwer Health

北京大学医学出版社

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图书在版编目（CIP）数据

洛克伍德-格林：成人骨折（精装版）= RockWood and Green's Fractures in Adults ：第8版 ：全2册 ：英文/(英)考特-布朗（Court-Brown,M.C.）等编. — 北京 ：北京大学医学出版社，2016.1

ISBN 978-7-5659-1137-8

Ⅰ. ①洛… Ⅱ. ①考… Ⅲ. ①骨折-治疗-英文 Ⅳ. ①R683.05

中国版本图书馆CIP数据核字(2015)第126819号

北京市版权局著作权合同登记号：图字01-2015-4298

Charles M. Court-Brown, James D. Heckman, Margaret M. McQueen, William M. Ricci, Paul Tornetta Ⅲ：RockWood and Green's Fractures in Adults, Eight edition

ISBN: 978-1-4511-9508-8

洛克伍德一格林：成人骨折（第8版）（精装版）

主　　编：Charles M. Court-Brown, James D. Heckman, Margaret M. McQueen, William M. Ricci, Paul Tornetta Ⅲ
出版发行：北京大学医学出版社
地　　址：（100191）北京市海淀区学院路38号 北京大学医学部院内
电　　话：发行部 010-82802230；图书邮购 010-82802495
网　　址：http://www.pumpress.com.cn
E-mail：booksale@bjmu.edu.cn
印　　刷：北京圣彩虹制版印刷技术有限公司
经　　销：新华书店
责任编辑：冯智勇　　责任印制：李　啸
开　　本：889mm×1194mm　1/16　印张：179.5　字数：5561千字
版　　次：2016年1月第1版　2016年1月第1次印刷
书　　号：ISBN 978-7-5659-1137-8
定　　价：680.00元（全2册）

出版说明

历经40余年，多次改版，《洛克伍德-格林：成人骨折》以其内容全面、系统、深入、实用，受到骨科医生的喜爱和推崇，成为创伤骨科最为经典、权威的学术著作，被誉为“骨科参考金标准”。现在呈现给您的，是《洛克伍德-格林：成人骨折》的最新版本——第8版。

《洛克伍德-格林：成人骨折》（第8版）由全球119位创伤骨科领域的顶尖专家共同编写。全书包括4部分，共62章，按照总论（包括基础、治疗原则、骨折类型、并发症）、上肢、脊柱、下肢分别阐述。本书在保持传统特色的同时，注重循证医学研究，全面反映了创伤骨科的最新知识、最新技术及发展趋势。这样一部创伤骨科“圣经”级著作不但有助于您获取最新、最权威的专业知识，而且可以学习经典教科书地道、专业的英语，可谓高端专业人士必备参考书。

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We dedicate this Eighth Edition of Rockwood and Green's: Fractures in Adults to Charles A. Rockwood, Jr, MD, and David P. Green, MD, who served as our inspiration and mentors for carrying on the revision and update of this textbook.

To Susan for her patience and understanding during my 30-year tenure on the editorial board.

JDH

To the future: Emily, Jessica, and Rosie.

CCB

To my children Sacha, Tyler, Robbin, and Everett for enriching my life every day, and my partner Niloofar for her love and support.

MMcK

To Caroline, Elizabeth, and William without whom life would be easier but much less fun.

MMcQ

To Ann, Michael, and Luke, my reasons for being, for their patience, love, and support.

WMR

To my mother Phyllis, who found the best in people, had compassion for all, and whose insight, guidance, and love have always made me believe that anything is possible.

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Preface

The eighth edition of *Rockwood and Green's: Fractures in Adults* continues with the changes that were instituted in the seventh edition. In this edition there are two more chapters and 61 new authors drawn from three continents and 11 different countries. In addition, many of the new authors represent the next generation of orthopedic trauma surgeons who will be determining the direction of trauma management over the next two or three decades.

Orthopedic trauma continues to be an expanding discipline, with change occurring more quickly than is often realized. When Drs. Rockwood and Green published the first edition in 1975, there were virtually no orthopedic trauma specialists in most countries, fractures were usually treated nonoperatively, and mortality following severe trauma was considerable. In one generation the changes in orthopedic surgery, as in the rest of medicine, have been formidable. We have worked to incorporate these changes in this edition. There is expanded coverage in this edition of the inevitable complications that all orthopedic surgeons have to deal with, and we have included chapters on geriatric trauma and the psychological aspects of trauma. The other area of orthopedic trauma that is expanding quickly, particularly in the developed countries, is the treatment of osteoporotic (or fragility) fractures. These fractures are assuming a greater medical and political importance, and orthopedic implants are now being designed specifically to treat elderly patients. It is likely that this trend will continue over the next few decades; many of the chapters in this edition reflect this change in emphasis.

The changes in the eighth edition include major changes in its chapter structure. Each of the clinical chapters now follows a specific template beginning with the physical examination, classification, and additional studies used in the diagnosis of each problem. This is followed by a description of the outcome measures used to evaluate patients for the specific injury they sustained. The indications and contraindications for each treatment method, including nonoperative and operative methods are highlighted in tables, as are the technical aspects of the surgeries. Old favorites such as pitfalls and problems are also listed in tables with solutions. Finally, the author's preferred treatment is now presented in the form of an algorithm, allowing the reader to understand the thought process of the expert writer in deciding on the treatment for the multiple subtypes of injuries described in each chapter. We believe that this will make it easy to get the most out of each chapter.

Finally, we are proud to introduce a new electronic format that should allow for easier access across platforms, a change that is overdue! Video supplementation is also available for the majority of the clinical problems.

We are indebted to the efforts of the experts who have taken the time to share their knowledge and experience with our broad readership and hope that this new edition will contribute to the care of patients.

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ROCKWOOD AND GREEN'S

Fractures in Adults

EIGHTH EDITION

Contents

General Principles

1

BIOMECHANICS OF FRACTURES AND FRACTURE FIXATION

Mark J. Jo, Allan F. Tencer, and Michael J. Gardner

INTRODUCTION TO BIOMECHANICS OF FRACTURES AND FRACTURE FIXATION

"Biomechanics" is a complex and encompassing term that applies to many aspects related to orthopedic surgery, and specifically to fractures and fracture fixation. The application of biomechanical principles and concepts is essential to understand how the fracture occurred, how to best treat the injury, and how to avoid mechanical failures of the fixation construct. One must first understand the fundamental terms and concepts related to mechanical physics. This establishes the foundation that will be used to apply these concepts to the field of orthopedic surgery. The biomechanical properties of bone as well as the biomechanics of fracture healing are also essential to understand how bone is injured and how to best restore its function. Finally, understanding the biomechanical properties of common implants and failures seen with their application helps the clinician to a thorough understanding that aids in patient care.

In the study of biomechanics as it relates to fracture fixation, the fundamental mechanical question remains: Is the fixation system stable and strong enough to allow the patient early mobility before bony union is complete? This must occur without delaying healing, creating bone deformity, or damaging the implant, and yet be flexible enough to allow transmission of force to the healing fracture to stimulate union. The common adage in orthopedics is that, "Fracture healing is a race between bony union and implant failure." A thorough understanding of the biomechanical concepts as they relate to bone, fracture, and implants is essential for the proper treatment of patients with fractures.

BASIC CONCEPTS

Before describing the performance of fracture fixation systems, some basic concepts used in biomechanics must be understood. A *force* causes an object to either accelerate or decelerate. It has *magnitude* (strength) and acts in a specific direction, which is termed a *vector.* However complex the system of forces acting on a bone, each force may be separated into its vector components (which form a 90-degree triangle with the force). Any of several components, acting in the same or different directions, can be added to yield the net or *resultant force.* As seen in Figure 1-1, a simplified example of the hip joint shows that the forces acting about the hip include the body weight, joint reactive force, and the hip abductors. As the hip in this example is at rest, the net force must be zero; therefore, if the body weight and hip abductor forces are known, the joint reactive

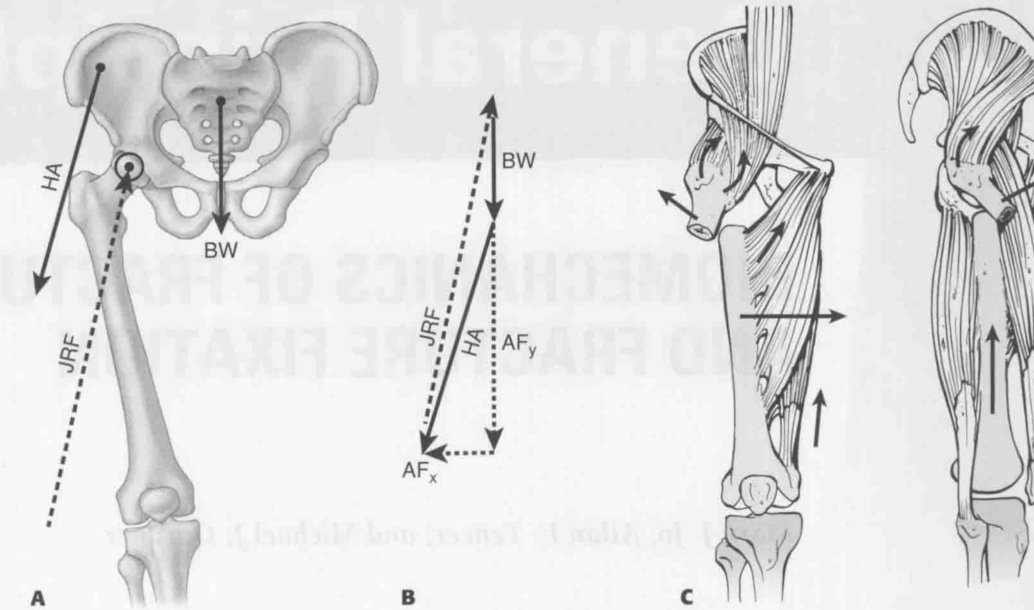

FIGURE 1-1 The force vectors acting on different parts of the body are a culmination of muscle, tendons, ligaments, and external forces. **A:** A simplified example of the force vectors acting on the hip joint. HA, hip abductors; BW, body weight; JRF, joint reactive force. **B:** Using the *x* and *y* vector components of the forces about the hip the joint reactive force (JRF) can be calculated because if the hip is at rest, the sum of all the forces should equal zero. AF_y (vertical component of HA force) AF_x (horizontal component of HA force). **C:** Understanding the forces that are applied about a fracture can help the surgeon understand the deforming forces and assist in reduction and fixation strategies.

force can be calculated using the *x* and *y* components of all the forces. Also, understanding the forces about a fracture help the surgeon to understand the deforming forces, the reduction maneuvers, as well as the proper application of implants to best stabilize the injury. Both the design of the implants as well as the application by the surgeon must be done with these concepts in mind so that they can withstand the mechanical loads applied without failure.

The two major loads acting on a long bone are those that cause it to displace in a linear direction (translation) and those that cause it to rotate around a joint center. Muscles typically cause a bone to rotate (e.g., the biceps causes the forearm to flex and supinate, the anterior tibialis causes the foot to dorsiflex). When a force causes rotation, it is termed a *moment* and has a *moment arm*. The moment arm is the lever arm against which the force acts to cause rotation. It is the perpendicular distance of the muscle force from the center of rotation of the joint. As shown in Figure 1-2, the moment or rotary force is affected not only by the magnitude of the force applied, but also by its distance from the center of rotation. In the example, two moments act on the outstretched arm. The weight carried in the hand as well as the weight of the hand and forearm rotate the arm downward, while the balancing muscle force rotates the forearm upward. Equilibrium is reached by balancing the moments so that the forearm does not rotate and the weight can be carried. Note that to achieve this, the muscle force must be eight times as large as the weight of the object, forearm, and hand because its moment arm or distance from the center of the joint is only one-eighth as long.

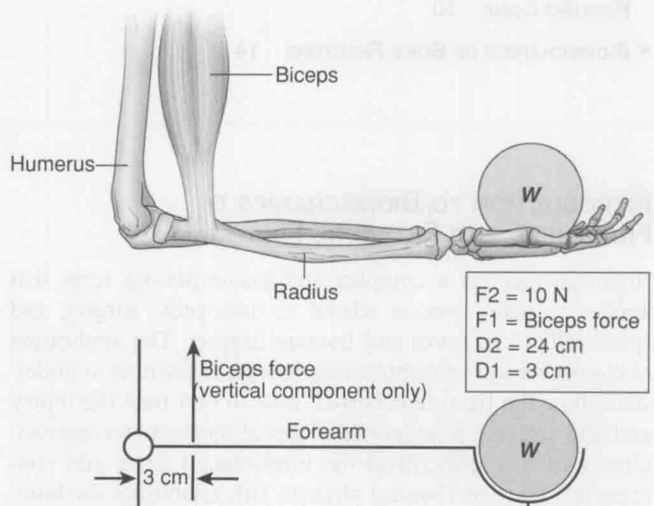

FIGURE 1-2 In this simplified example of a free body diagram, the outstretched arm is a lever and is at rest. The rotational force, or the moment, is centered about the elbow. This moment is defined as the product of the weight (object + forearm + hand) (F_2) and the distance from the elbow (d_2). This moment must be counteracted by a moment in the opposite direction. In this example the vertical component of the biceps force (F_1) is the counteractive force. The lever arm of this force is the distance from the elbow to the insertion of the biceps (d_1). The biceps force is calculated from 10 kg × 24 cm = F_1 × 3 cm. Thus F_1 = 80 N. The biceps force is much greater than the weight of the object, arm, and hand because its lever arm is smaller.