

James M. Daniels
William W. Dexter
Editors

Basics of Musculoskeletal Ultrasound

Basics of Musculoskeletal Ultrasound

James M. Daniels • William W. Dexter
Editors

Basics of Musculoskeletal Ultrasound

 Springer

Editors

James M. Daniels, MD, MPH, FAAFP,
FACOEM, FACPM
Departments of Family and Community Medicine
Department of Orthopedic Surgery
Southern Illinois University School of Medicine
Quincy, IL, USA

William W. Dexter, MD, FACSM
Sports Medicine and Family Medicine
Maine Medical Center
Tufts University School of Medicine
Portland, ME, USA

ISBN 978-1-4614-3214-2 ISBN 978-1-4614-3215-9 (eBook)
DOI 10.1007/978-1-4614-3215-9
Springer New York Heidelberg Dordrecht London

Library of Congress Control Number: 2013934108

© Springer Science+Business Media New York 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Acknowledgments

This project demonstrated, like most worthwhile things in life, that we are dependent on each other and our sum is much greater than our parts. Without the following people, this book would not have existed. Thank you!

Linda Savage and Diane Lamsback—your untiring efforts and skills drove this project.

Toby, Mags, Lizzie, Ellie, and my wife, Kate, the loves of my life—thank you for putting up with dining room tables filled with manuscripts and a sometimes preoccupied father/husband.

Bill “The Dude” Dexter—you almost left us. Glad you are still around man. You continue to show us how to *really* live! Muchas gracias, compadré. Jay Smith, Lev Nazarian, and Jon Jacobson—you started the revolution and cleared the path! The chapter authors, all outstanding clinicians and MSK ultrasound gurus—you showed us the way! Our students, residents, and fellows—you are our future!

Ancora Imparo!

James M. Daniels

Many thanks to my fellows, past, present, and future, who give me direction and purpose and joy in what I do. Special thanks to Hatz and Kate. There is a lot of both of you in this book. And to my lovely and patient wife, Cindy, and our children, Ben, Sam, and Hannah, on whom I practiced my ultrasound skills and with whom I will now surely move on to the next adventure.

William W. Dexter

Contents

1 Introduction	1
James M. Daniels and William W. Dexter	
2 Understanding Accreditation and Certification in Musculoskeletal Ultrasound	3
Joshua G. Hackel	
3 Choosing Ultrasound Equipment	7
Paul D. Tortland	
4 Knobology	11
Allyson S. Howe	
5 Tissue Scanning	15
J. Herbert Stevenson	
6 Hand and Fingers	29
Matthew C. Bayes	
7 Wrist	35
Joseph J. Albano	
8 Elbow	43
Pierre d’Hemecourt	
9 Shoulder	53
Mark E. Lavallee	
10 Foot and Toes	63
Kevin deWeber	
11 Ankle	69
John Hatzenbuehler	
12 Knee	77
Patrick A. Smith and Matt E. Thornburg	
13 Hip	87
John Charles Hill and Matthew S. Leiszler	
14 Groin	93
Anthony E. Joseph	
15 Ultrasound Guidance of Injections	99
Erik Adams	

16 Rheumatologic Findings	119
Ralf G. Thiele	
Appendix: Musculoskeletal Ultrasound Checklist	127
Index	129

Contributors

Erik Adams Midwest Sports Institute, Middleton, WI, USA

Joseph J. Albano Department of Regenerative Medicine, Comprehensive Orthopedics and Sports Medicine, Salt Lake City, UT, USA

Matthew C. Bayes Crane Clinic for Sports Medicine, Chesterfield, MO, USA

James M. Daniels Departments of Family and Community Medicine and Orthopedic Surgery, Southern Illinois University School of Medicine, Quincy, IL, USA

Kevin deWeber Department of Family Medicine, Uniformed Services University of the Health Sciences, Bethesda, MD, USA

William W. Dexter Sports Medicine and Family Medicine, Maine Medical Center, Tufts University School of Medicine, Portland, ME, USA

Pierre d’Hemecourt Division of Sports Medicine, Primary Care Sports Medicine, Boston Children’s Hospital, Boston, MA, USA

Joshua G. Hackel University of West Florida, Pensacola, FL, USA

Primary Care Sports Medicine, The Andrews Institute, Gulf Breeze, FL, USA

John Hatzenbuehler Department of Family Medicine, Maine Medical Center, Portland, ME, USA

John Charles Hill Family Medicine and Sports Medicine, University of Colorado School of Medicine, Denver, CO, USA

Allyson S. Howe Department of Family Medicine, Maine Medical Center, Portland, ME, USA

Anthony E. Joseph Portneuf Medical Center, Pocatello Orthopaedic and Sports Medicine Institute/Idaho State University, Pocatello, ID, USA

Mark E. Lavalley South Bend-Notre Dame Sports Medicine Fellowship Program, South Bend, IN, USA

Department of Family Medicine, Indiana University School of Medicine, Indianapolis, IN, USA

Memorial Hospital of South Bend and Memorial Medical Group, South Bend, IN, USA

Indiana University South Bend, South Bend, IN, USA

Holy Cross College, South Bend, IN, USA

University of Notre Dame, Men’s Soccer Team, South Bend, IN, USA

USA Weightlifting, Sports Medicine Society, Colorado Springs, CO, USA

Division of Sports Medicine, Department of Family Medicine, Memorial Hospital of South Bend, South Bend, IN, USA

Matthew S. Leiszler Family Medicine and Sports Medicine, University of Colorado School of Medicine, Denver, CO, USA

Linda Savage Department of Family and Community Medicine, SIU School of Medicine, Quincy, IL, USA

Patrick A. Smith Department of Orthopaedic Surgery, University of Missouri Hospitals and Clinics, Columbia, MO, USA

Columbia Orthopaedic Group, Columbia, MO, USA

J. Herbert Stevenson Departments of Family and Community Medicine and Orthopedics and Rehabilitation, University of Massachusetts Medical Center, University of Massachusetts Medical School, Worcester, MA, USA

Ralf G. Thiele Division of Allergy/Immunology and Rheumatology, Department of Medicine, University of Rochester, Rochester, NY, USA

Matt E. Thornburg Columbia Orthopaedic Group, Columbia, MO, USA

University of Missouri, Columbia, MO, USA

Paul D. Tortland Valley Sports Physicians and Orthopaedic Medicine, Avon, CT, USA

James M. Daniels and William W. Dexter

Clinical ultrasonography has been around for decades. In Europe, it also has been used for many years, but the way it is utilized differs from the system developed in North America.

In Europe, ultrasound scanning is introduced to medical students very early in their training. These skills are then supplemented in postgraduate training. In the United States, clinical examination skills are taught to all students, but very few are exposed to clinical ultrasonography. Traditionally, a clinician examines the patient, and if it is determined that an ultrasound study is necessary, a comprehensive scan is performed by a highly trained technician, a sonographer. The images are then interpreted by a highly trained physician, a radiologist, who then generates a detailed report back to the clinician. This paradigm has shifted slightly over the years, with cardiologists and obstetricians using ultrasound as a bedside tool to practice medicine, but this training is limited in scope and is only taught in residency or fellowship. Recently, the United States has adopted a hybrid of these two systems, referred to as “point-of-care” ultrasonography. Students and practicing clinicians are now being trained to use bedside ultrasound as an important tool to diagnose and treat patients (i.e., starting central lines in the ICU, FAST scans in the Emergency Department, dynamic scanning of shoulder joint).

This model integrates the history and physical exam along with treatment decisions into one process by one clinician. It not only decreases the cost and time of the process, it allows

the clinician to evaluate three-dimensional real-time anatomy and physiology, which further adds to the accuracy of the diagnosis. These “point-of-care” musculoskeletal ultrasound studies (POC MSK/US) may or may not always include the “comprehensive” evaluation that traditional ultrasound examinations do, depending on the reason they were performed. These scans are to supplement the clinical examination and should not be used as a stand-alone way to diagnose the patient’s condition. The use of the ultrasound machine can be compared to the use of a stethoscope in the clinical setting. The stethoscope, as we know it, was first used in France in the early 1800s by Dr. René Laennec, but it wasn’t widely used until the mid-1900s, when Rappaport and Sprague were able to mass-produce a lightweight, relatively affordable model. Ultrasound technology is currently following this trend. We predict that POC US will be the stethoscope of the twenty-first century. In fact, the year 2013 has been heralded as “The Year of Sonography” by a number of health-care organizations. The use of POC US has vastly changed the way musculoskeletal medicine is being practiced today and will transform the way we practice in the future.

We propose to use an ultrasound machine as one would a stethoscope—to no longer view it as a test to be ordered but as an extension of the physical examination. Most textbooks on this subject are written by radiologists with years of experience in the traditional paradigm described above. This book is written by busy clinicians with decades of experience using clinical ultrasound and could be used as a stand-alone curriculum for POC MSK/US.

This book is laid out in a way to become a bedside aid to assist in POC MSK/US scanning. Each chapter emphasizes one particular skill set. Introduction chapters demonstrate knobology, tissue scanning techniques, and the certification/accreditation process for MSK/US. Later chapters concentrate on particular regions of the body. The main focus of each chapter revolves around a table that shows probe positions, patient positioning, surface anatomy, and underlying structures to be scanned. A small amount of text accompanies each table, but this book focuses on clinical exam skills. A list

J.M. Daniels, M.D., MPH (✉)
Departments of Family and Community Medicine and Orthopedic Surgery,
Southern Illinois University School of Medicine,
612 North 11th Street, Quincy, IL 62301, USA
e-mail: jdaniels@siu.edu

W.W. Dexter, M.D., FACM
Sports Medicine and Family Medicine, Maine Medical Center,
Tufts University School of Medicine,
272 Congress Street, Portland, ME 04101, USA
e-mail: dextew@mmc.org

of “red flags,” potentially serious conditions to consider, and “clinical pearls” or tips to improve scanning techniques is also included. We have also included a number of clinical exercises or “homework” that can be used to improve and document your scanning skills. A “check-off” list of important structures to evaluate is also provided along with some examples of sample reports.

Many other references are available to explain detailed anatomy and scanning techniques. Please refer to them if needed. This book was developed to be used at bedside and to assist in scanning. Many of the chapter authors of this book also teach POS MSK/US. When we asked them what was the best advice they could give clinicians who want to incorporate

these skills in their practice, they gave three recommendations: “PRACTICE! PRACTICE! PRACTICE!”

Although this book can be used at a POC MSK/US training course, it is designed to assist clinicians to scan. If one waits until one has “perfect” technique and all the anatomy memorized, one will never be able to fully utilize this technology. These skills are integrative, not additive. The use of MSK/US will not only decrease the cost but also increase the effectiveness of treatment (the definition of high quality of health care proposed by some experts). In addition, it allows us to touch our patients, which has been shown to increase both patient and provider satisfaction when it comes to providing health care.

Understanding Accreditation and Certification in Musculoskeletal Ultrasound

Joshua G. Hackel

What Is the Difference Between Accreditation and Certification for Musculoskeletal Ultrasound?

It is important to understand the essential differences between accreditation and certification.

Accreditation

The term “accreditation” is typically used to refer to practices, not people. Therefore, a person or group of people can choose to have their practice “accredited” by a recognized accrediting body. The accrediting body awards practice accreditation to those practices that adhere to certain standards. The standards themselves may vary among different organizations but would generally include language concerning the qualifications of the people performing in that practice, the equipment used (type and maintenance), and the logistics of the practice (patient scheduling, documentation, use of protocols, emergency plans, etc.). Common examples would be fellowship accreditation by the American College of Graduate Medical Education (ACGME) or hospital accreditation by the Joint Commission on the Accreditation of Health Care Organizations (JCAHO).

Certification

The term “certification” is typically used to refer to people/individuals and not practices. Therefore, a person may

become certified in a field or technique by demonstrating that he or she has met specific standards. For the most part, this includes documentation of prerequisites (e.g., Continuing Medical Education [CME] and/or years of experience) and passing some type of test (written and/or practical). Individual certification may be used to document an individual’s competency in support of an application for practice accreditation, but practice accreditation will not typically suffice to obtain certification. The obvious example is that many, if not most, American Medical Society for Sports Medicine (AMSSM) members are “certified” in sports medicine once they meet the prerequisites (e.g., completion of fellowship) and pass the test that is managed by an outside institution (Board of Medical Examiners).

What Organizations Have Set Up a System for Accreditation and Certification?

Accreditation

Practice accreditation for musculoskeletal ultrasound (MSK/US) is currently available through the American Institute of Ultrasound in Medicine (AIUM). The AIUM is a nonprofit, multidisciplinary organization dedicated to advancing safe and effective use of ultrasound in medicine through professional and public education, research, development of guidelines, and practice accreditation. Although the AIUM promotes all types of US, the organization has recently focused on the emerging field of MSK/US, supporting guideline development, education, advocacy, and, of course, practice accreditation. The AIUM has a long history of practice accreditation and is recognized as a legitimate accrediting organization by CMS and third-party payers. At this time, AIUM practice accreditation is the only available practice accreditation in MSK/US. You do not have to be a member of the AIUM to have the AIUM accredit your practice. We are currently not aware of any other organizations developing practice accreditation in MSK/US. If you are

J.G. Hackel, M.D. (✉)
University of West Florida, Gulf Breeze, FL, USA

Primary Care Sports Medicine, The Andrews Institute,
1040 Gulf Breeze Parkway, Suite 200, Gulf Breeze, FL 32561, USA
e-mail: joshua.hackel@bhcpns.org