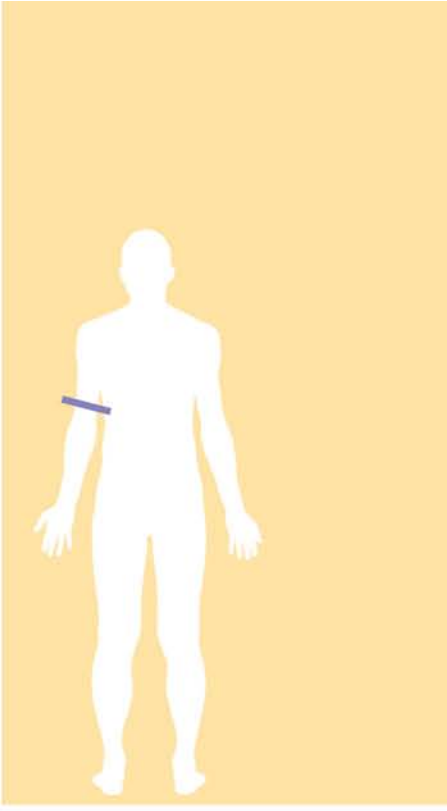
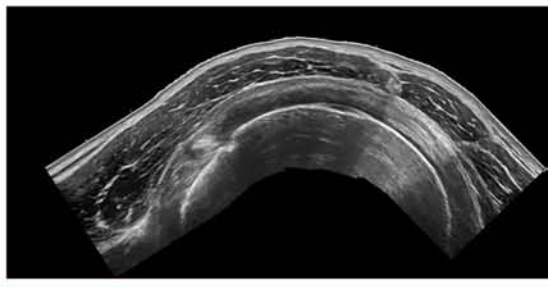
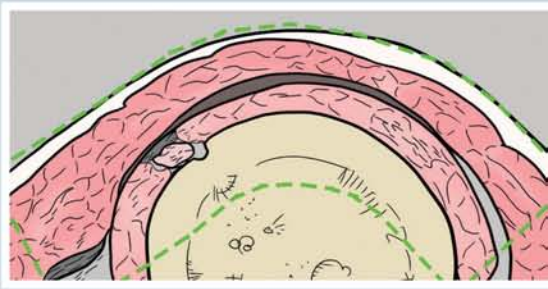
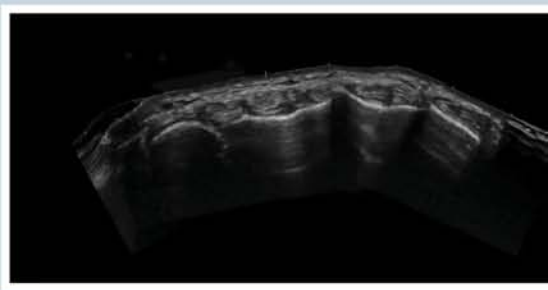
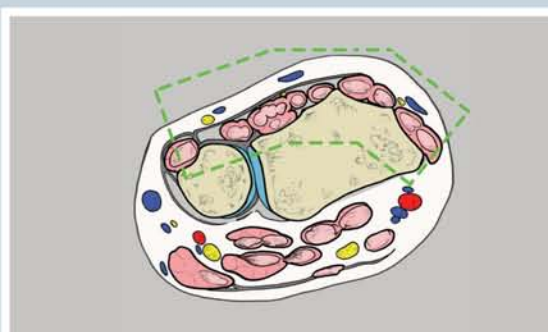
MUSCULOSKELETAL ULTRASOUND CROSS-SECTIONAL ANATOMY











JOHN C. CIANCA
SHOUNUCK I. PATEL

demosMEDICAL
An Imprint of Springer Publishing

Musculoskeletal Ultrasound Cross-Sectional Anatomy

Musculoskeletal Ultrasound Cross-Sectional Anatomy

John C. Cianca, MD

Adjunct Associate Professor of Physical Medicine and Rehabilitation
Baylor College of Medicine
University of Texas Health Science Center
Human Performance Center
Houston, Texas

Shounuck I. Patel, DO, MMS

Interventional Regenerative Orthopedic Medicine
Regenexx-Health Link Medical Center
Los Angeles, California

demosMEDICAL
An Imprint of Springer Publishing
NEW YORK

Visit our website at www.demosmedical.com

ISBN: 9781620700624
ebook ISBN: 9781617052279

Acquisitions Editor: Beth Barry
Compositor: diacriTech

Library of Congress Cataloging-in-Publication Data
Names: Cianca, John C., author. | Patel, Shounuck I., author.
Title: Musculoskeletal ultrasound cross-sectional anatomy / John C. Cianca, Shounuck I. Patel.
Description: New York: Demos Medical Publishing, [2017] | Includes bibliographical references and index.
Identifiers: LCCN 2017011023| ISBN 9781620700624 | ISBN 9781617052279 (ebook)
Subjects: | MESH: Musculoskeletal System—anatomy & histology | Anatomy, Cross-Sectional | Ultrasonography—methods | Atlases
Classification: LCC QM100 | NLM WE 17 | DDC 612.7—dc23 LC record available at https://lccn.loc.gov/2017011023

Printed in the United States of America by Publishers' Graphics.

17 18 19 20 21 / 5 4 3 2 1

To my parents, Louis and Antoinette Cianca, who gave me their unwavering support and confidence. Their selfless dedication to my growth and development enabled me to achieve my goals. My mother's gentle and compassionate thoughtfulness and my father's devotion to a job well done have inspired me and shaped me.

John Cianca

To my mom, thank you for teaching me how to draw and for cultivating my love of art.

To Chloe, thank you for making me chase you, your energy never ceases to motivate me.

And most of all to my wife, Payal, thank you for supporting my passions, pushing me to pursue my dreams, and putting up with my long hours.

Shounuck Patel

Contents

Foreword

The field of musculoskeletal sonography has advanced rapidly during the past decade. Today, technological innovations, supportive research, and an accumulated collective clinical experience continue to inspire clinicians and sonographers to integrate this powerful modality into clinical practice. Many medical schools, residency programs, and fellowships now offer MSK sonography training as part of their standard curricula. The proliferation of MSK sonography has created a knowledge gap with respect to education. Although this gap has been narrowed by an increasing number of textbooks, online courses, and live educational experiences, there remains a need for a contemporary, high-quality MSK sonographic anatomical atlas. This atlas fulfills that need.

When I started learning MSK sonography in 2003, I was continually reminded by my mentors that anatomy was the key to MSK sonography—ANATOMY—ANATOMY—ANATOMY. Despite reading articles and textbooks and attending courses, the foundation of my MSK sonography training was built using a standard anatomy textbook while I scanned myself, someone else, or worked in the anatomy lab. In fact, it was only after truly understanding the sonographic anatomy that I could optimally benefit from reading those articles and textbooks, or attending those courses.

As an experienced sonologist, Dr. John Cianca also recognizes the importance of cross-sectional anatomy in the field of MSK sonography. When John informed me he was working on this project, I immediately acknowledged the need for a high-quality atlas demonstrating MSK sonographic cross-sectional anatomy. This atlas

takes the user on a comprehensive ultrasound guided tour of the MSK system. The atlas is well organized, intuitive, and user friendly. Although it can be read "cover to cover" it is certainly not necessary to do so. The user can easily find an anatomic region of interest and rapidly learn or review the relevant sonographic anatomy. The combination of figures and extensively labeled ultrasound images is a differentiating factor among ultrasound texts. The emphasis on pattern recognition—echotextural differences between various tissue types—is appreciated. A major strength of this atlas is its wide scope of influence, as its content is equally applicable to both the medical student initially learning MSK sonography and the experienced sonologist or sonographer needing to quickly review a specific region in the clinic.

I am privileged to contribute this foreword to Dr. Cianca's *Musculoskeletal Ultrasound Cross-Sectional Anatomy*. This work represents a much-needed addition to the exciting and expanding field of MSK sonography. Although I regret that I did not have access to it during my initial MSK sonographic training, I am pleased that it is now available for everyone to learn from and use to improve the care of our patients. I will certainly have a copy on my shelf.

Jay Smith, MD
Rochester, Minnesota

Preface

Diagnostic and interventional sonography has become an important clinical tool for physicians treating musculoskeletal conditions. It is practical to use in the clinic setting and even in the field. It is cost-effective and provides point-of-care results. Furthermore, as a clinical imaging modality it is much more adaptable to a clinical question than other modalities. It has made my practice more informed and using sonography has brought anatomy to life in my office. Sonography is a very useful tool for those who desire to fill out and test the differential diagnosis that is created with history and physical examination.

Having taught musculoskeletal ultrasound for more than 10 years, I have become aware that learners often lack understanding of spatial relationships within an anatomic region. They need to develop visual acuity to cross-sectional anatomy, which is not a focus of teaching anatomy in medical school. However, this visual awareness is essential to being able to understand sonographic images.

It is the aim of this atlas to use cross-sectional sonographic images to promote a better understanding of clinical anatomy. Each image is accompanied by an illustration that serves as a road map to the image and highlights important structures. This will help the learner develop an eye for anatomic relationships in the body by comparing the sonograph to a more familiar format (the illustration). Furthermore, both image and illustration will make apparent the dynamic nature of these anatomic relationships.

One of the hurdles I have seen in mastering ultrasound as a diagnostic tool is learning to understand and recognize the spatial relationships of anatomic structures. One of the first things taught in training sonographers is the echogenic appearance

of various tissues. This pattern recognition is critical to deciphering a sonographic image. This atlas will expand that pattern recognition to include all of the tissues in a cross-sectional image and each accompanying illustration provides a visual translation of the sonograph.

An ultrasound beam is remarkably thin and gives a very narrow field of view. When a structure is viewed in long axis, it is a very limited field of view indeed. However, when viewed in short axis that field of view expands dramatically and becomes demonstrative of the regional anatomic relationships, albeit in a 1-mm slice. This is how a learner develops spatial awareness of a region. The cross-sectional images displayed in this atlas, many of which are extended field of view, were chosen to highlight important aspects of an anatomic region. There are also selected extended field of view images along the long axis of a structure to add another dimension to the area of study. Using an extended field of view image can make long axis imaging much more demonstrative of an entire structure. These images can be very striking in their illustrative nature. In some areas, this image can take on the visual magnitude of an axial MRI image.

I have identified cross-sections of each segment of the upper extremity and lower extremity that are important to understand as visual touchstones for anyone performing diagnostic sonography. Each is placed alongside an illustration that documents the structures in the sonograph. I am indebted to Shounuck Patel, DO, my coauthor. His artistic talent coupled with his understanding of anatomy will allow this atlas to be a guide to sonographers. Each illustration is a key that unlocks the content of the sonographic image it accompanies by translating each sonograph into the more common visual language of anatomy. These translations will enable the reader to assimilate the sonographs into their visual acumen and thus move forward in their use of musculoskeletal sonography.

There is also a legend for every image/illustration couplet that allows the user to identify individual structures in each. There is a body icon with the cursor in the location of each image/illustration couplet to help the reader localize the position of each sonograph. In addition to the normal anatomy, there are also a few images of pathology that demonstrate how pathology is represented in a sonograph.

My journey into diagnostic sonography has been wonder-filled and fascinating. I hope that you find this atlas helpful in guiding you to understand the complex and dynamic musculoskeletal relationships of the human body in a more complete spatial context.

John Cianca, MD

Acknowledgments

I would like to thank Christopher Visco, MD, and Jeffrey Strakowski, MD, for reviewing this work. Their thoughtful edits and insights have been invaluable.

I would also like to thank Sandra Shriner, MD; Kathy Travnicek, MD; Carolyn Kienstra, MD; Katie Cannizzaro, PT; Ugochi Azuike, MD; Barbara Trautner, MD; Cathy Thompson; Uzoh Ikpeama, MD; Phuong Nguyen; Alan Swearingen, MD; Angela Cortez, MD; Bao Van, MD; Joslyn John, MD; and Prathap Jayaram, MD, for their help in creating these images.

I would also like to thank Joe Stubenrauch and the staff at Demos Medical Publishing, LLC, for their technical support. Finally, I would like to thank Beth Barry, whose support gave me the courage to pursue this idea and whose patience with me allowed it to be completed.

John Cianca, MD

If I have seen further than others, it is by standing upon the shoulders of giants

Isaac Newton

I would like to thank my influencers and mentors who have been instrumental in my learning art, anatomy, and ultrasound: Ila Patel; Jim Lee; Frank Netter, MD; Dennis Dowling, DO; Todd Stitik, MD; Patrick Foye, MD; Gautam Malhotra, MD; Susan Garstang, MD; Rex Ma, MD; Gerard Malanga, MD; Mooyeon Oh-Park, MD; Gary Chimes, MD; Chris Visco, MD; Mike Furman, MD; Jim Gilhool, DO; Marco Bodor, MD; Scott Primack, DO; and John Cianca, MD.

I would also like to thank Joslyn and Prathap for connecting me with John for this collaboration. John, thank you for this amazing opportunity and for opening all our eyes to this new perspective on musculoskeletal ultrasound. Finally, thank you to Beth; this project would not have been possible without your guidance and perseverance.

Shounuck Patel, DO