

# Musculoskeletal Ultrasound in Rheumatology Review

Minna J. Kohler  
Editor

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 Springer

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*I would like to dedicate this book to my  
parents Kahp and Michelle So, my husband  
Ed, and daughter Evelyn; thank you for your  
unconditional love and support.*

# Preface

Point-of-care ultrasound, or ultrasound performed and interpreted by the clinician in the clinic/office or at the bedside, has been rapidly expanding in use among multiple medical specialties. Musculoskeletal ultrasound (MSKUS) has added value to clinical care both diagnostically and for accurate needle guidance of musculoskeletal procedures. Many fellowship training programs in rheumatology, as well as residency training in other specialties (e.g., physical medicine and rehabilitation, orthopedics, podiatry, emergency medicine), are now offering MSKUS education. As clinicians are increasingly incorporating MSKUS into daily clinical practice, there is a growing need for educational resources. With this in mind, it is my pleasure to present the first edition of *Musculoskeletal Ultrasound in Rheumatology Review*. This concise review book is designed for rheumatologists, as well as other musculoskeletal providers, learning and practicing the valuable skill of point-of-care MSKUS. It is intended to serve as a practical guide for learning the fundamentals of normal sonographic anatomy and understanding how MSKUS can be incorporated into clinical care to expedite the diagnosis and management of common rheumatologic and musculoskeletal problems. Review questions are presented at the end of each chapter designed to highlight the essential concepts the reader should learn. These questions also serve as a self-evaluation and may be helpful for exam preparation.

## Organization

The book begins with an introduction to MSKUS which includes indications for MSKUS use in rheumatologic diseases, basic physics, and a “how-to” approach on learning about ultrasound equipment, image acquisition techniques, and common artifacts. The next chapter, “[Basic Ultrasound Pathology](#),” reviews the general sonographic appearance of normal anatomy in contrast to commonly encountered rheumatologic abnormalities with supporting literature review. The evaluation of joint inflammation is critical in rheumatology, and therefore a dedicated chapter,

“[Synovitis Evaluation](#),” reviews how to optimize Doppler settings and discusses the current literature involving various synovitis scoring systems.

The following chapters review the normal sonoanatomy of the major upper and lower extremity regions (hand/wrist, elbow, shoulder, hip, knee, ankle/foot) and image acquisition of these areas using standardized scanning protocols. Commonly encountered sonopathology in rheumatologic and musculoskeletal conditions is also reviewed.

Point-of-care ultrasound use has been expanding in children, as well as adults. The next chapter, “[Pediatric Ultrasound](#),” reviews important sonographic differences to consider between adults and children with particular focus on careful interpretation of normal versus pathologic ultrasound images in rheumatologic patients. Due to the scope of this book, emphasis on fractures, dislocations, and other musculoskeletal issues that may be seen in emergency settings is not included.

Musculoskeletal providers are well versed in joint aspirations and injections. Perhaps more commonly adopted than diagnostic ultrasound, ultrasound guidance of procedures allows the clinician to provide accurate, less painful procedures. It has increased accessibility to additional treatment options in the clinic, such as hip joint injections, that traditionally are not performed without guidance. The chapter “[Ultrasound-Guided Injections](#)” reviews the literature supporting ultrasound guidance and describes joint injection techniques for commonly encountered musculoskeletal problems.

The last chapter, “[Vasculitis Ultrasound](#),” offers an exciting look at how ultrasound can potentially change the diagnosis and treatment monitoring of patients with giant cell arteritis and large vessel vasculitis. Vasculitis ultrasound has gained acceptance at select European institutions, particularly in Germany, but has not been considered routine care in the United States. While vascular ultrasound anatomy is not typically taught at introductory musculoskeletal ultrasound courses, this chapter offers for the first time in publication a “how-to” approach on obtaining appropriate ultrasound images to assess vasculitis.

In view of the important strides that MSKUS has made in clinical care and the changing clinical practices of musculoskeletal providers using advanced ultrasound technology, I hope this book fills an increasing educational need and provides a comprehensive, practical guide to MSKUS for rheumatologic and musculoskeletal diseases.

Boston, MA, USA

Minna J. Kohler

# Acknowledgements

I would like to thank all the authors and contributors who have made this book come to fruition. Their time, energy, expertise, and commitment to this project have made this concise, up-to-date review book for musculoskeletal ultrasound in rheumatology a valuable resource for clinicians incorporating musculoskeletal ultrasound into their clinical care. I sincerely appreciate all their hard work and dedication and am happy to have them as my colleagues. Without them, this book would not have been possible.

I would like to give special thanks to my mentors:

Dr. Joseph Craft, Paul B. Beeson Professor of Medicine (Rheumatology) and Professor of Immunobiology; Section Chief, Rheumatology; Program Director, Investigative Medicine at Yale University School of Medicine. His guidance and advice in my academic career have profoundly influenced my efforts.

Dr. Liana Fraenkel, Professor of Medicine (Rheumatology) at Yale University School of Medicine, and Section Chief of Rheumatology, Connecticut Veterans Administration Medical Center. Dr. Fraenkel has inspired me by being an amazing role model. Her unconditional mentoring, support, and encouragement for my career and research endeavors have been valuable beyond words to me.

Dr. John S. Reach, Associate Professor of Orthopaedics and Rehabilitation and Director of the Foot and Ankle Section at Yale University School of Medicine. Dr. Reach first introduced me to point-of-care musculoskeletal ultrasound and I am grateful for the dedicated opportunity I had to learn from him.

Dr. John H. Stone, Professor of Medicine at Harvard Medical School and Clinical Director of Rheumatology at Massachusetts General Hospital. I thank Dr. Stone for his continuous support, encouragement, and guidance for my academic career.

I am also grateful to Stephanie Frost, for her continuous and unwavering support for this project, and the entire Springer team in assembling, editing, and publishing this project. It has been a pleasure working with all of you on this book.

# Contents

<b>Introduction: Musculoskeletal Ultrasound Indications and Fundamentals</b> .....	1
Wolfgang A. Schmidt	
<b>Basic Ultrasound Pathology</b> .....	23
Jonathan Samuels and Karina D. Torralba	
<b>Synovitis Evaluation</b> .....	57
Hilde Berner Hammer and Lene Terslev	
<b>Ultrasound of the Hand and Wrist</b> .....	75
Eugene Kissin	
<b>Ultrasound of the Elbow</b> .....	103
Amy M. Evangelisto and Minna J. Kohler	
<b>Ultrasound of the Shoulder</b> .....	123
Gurjit Singh Kaeley	
<b>Ultrasound of the Hip</b> .....	151
Naina Rastalsky	
<b>Ultrasound of the Knee</b> .....	173
Amanda E. Nelson and Jake Ritt	
<b>Ultrasound of the Ankle and Foot</b> .....	203
Jay B. Higgs	
<b>Pediatric Ultrasound</b> .....	233
Johannes Roth	

**Ultrasound-Guided Injections** ..... 265  
Wilmer L. Sibbitt Jr.

**Ultrasound in Vasculitis**..... 319  
Andreas P. Diamantopoulos

**Index**..... 347

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**Andreas P. Diamantopoulos, MD, PhD** is the founder and director of the first international ultrasound workshop in LVV Ultrasound in Kristiansand, Norway, where he established the first fast track vasculitis ultrasound clinic and musculoskeletal ultrasound clinic. He has been a vascular ultrasound course instructor at the ACR and EULAR. He is now the head of rheumatology at the Hospital for Rheumatic Diseases in Haugesund, Norway and a consultant for the Department of Rheumatology at the Hospital of Southern Norway Trust in Kristiansand. He is member of the ACR/EULAR research group for polymyalgia rheumatica, giant cell arteritis, the European Vasculitis Study Group (EUVAS) and the OMERACT LVV ultrasound subgroup. Dr. Diamantopoulos' main research interests are in vasculitis and ultrasound.

**Amy M. Evangelisto, MD, FACR, RhMSUS** is an ACR ultrasound faculty instructor and current president of USSONAR. She is the past committee chair for the ACR musculoskeletal ultrasound education committee and served on the ACR musculoskeletal ultrasound certification task force. She is the former director of the Cooper University musculoskeletal ultrasound program and course. Dr. Evangelisto has trained with the musculoskeletal ultrasound group in Leeds, England and currently performs musculoskeletal ultrasound in clinical practice.

**Hilde Berner Hammer, MD, PhD** teaches musculoskeletal ultrasound around the world and is an instructor for EULAR ultrasound courses. She is an OMERACT group member in musculoskeletal ultrasound. Her research work focuses on the use of musculoskeletal ultrasound and power Doppler evaluation in rheumatic diseases.

**Jay B. Higgs, MD, FACP, FACR, RhMSUS** is an ACR ultrasound faculty instructor and USSONAR President. He established the rheumatology musculoskeletal ultrasound program at San Antonio Military Medical Center where he is also the rheumatology fellowship program director. He participated in the ACR Ultrasound Certification Task Force. Dr. Higgs remains active in teaching rheumatologists,

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**Gurjit Singh Kaeley, MBBS, MRCP, FACR, RhMSUS** is a passionate practitioner and teacher of musculoskeletal sonography in Rheumatology practice. He is board certified in Internal Medicine and Rheumatology and is the Division Chief, Clinical Professor of Medicine, and Program Director for Musculoskeletal Ultrasound at the University Of Florida College Of Medicine, Jacksonville. He has directed many sonographic courses including the American College of Rheumatology Intermediate Musculoskeletal Ultrasound Courses. He was the founding president of USSONAR and continues to serve as a faculty member. His research interests include the application of sonography to Spondyloarthropathies, Gout and Rheumatoid arthritis, utilization and cost benefits of musculoskeletal ultrasound as well as cardiovascular risk stratification using carotid IMT.

**Eugene Kissin, MD, FACR, RhMSUS** is an ACR ultrasound faculty instructor and the USSONAR founder and program director. He served on the ACR musculoskeletal ultrasound certification task force and is the committee chair for the ACR musculoskeletal ultrasound education committee. He is an OMERACT group member in musculoskeletal ultrasound. Dr. Kissin established the rheumatology musculoskeletal ultrasound training program and certification pathway at Boston University Medical Center, where he is the rheumatology fellowship program director, and director of resident and student education in rheumatology. He conducts research in musculoskeletal ultrasound education and its clinical applications.

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**Naina Rastalsky, MD, FACR, RhMSUS** is an USSONAR graduate and was the first rheumatology fellow to obtain 3 years of dedicated musculoskeletal ultrasound training at the Massachusetts General Hospital, where she performed many ultrasound-guided procedures and was a research co-investigator for a clinical study on greater trochanteric pain syndrome with Dr. Kohler. Dr. Rastalsky practices rheumatology at the Bone and Joint Center and currently teaches rheumatology to internal medicine residents and medical students.

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**Wolfgang A. Schmidt, MD** initiated the first musculoskeletal ultrasound workshops at the American College of Rheumatology (ACR). He organized several European League Against Rheumatism (EULAR) ultrasound courses and initiated the first EULAR Teacher Course. He is an OMERACT (Outcome Measures for Arthritis Clinical Trials) group member in musculoskeletal ultrasound and the lead of the Large Vessel Vasculitis (LVV) Ultrasound Sub-taskforce. He teaches musculoskeletal and vascular ultrasound around the world and has been an ultrasound mentor to many rheumatologists.

**Wilmer L. Sibbitt, Jr, MD, FACR** is an ACR ultrasound faculty instructor. He is the founder and director of rheumatologic ultrasound at the University of New Mexico Health Sciences Center where he performs many ultrasound-guided procedures and actively teaches rheumatology fellows. He is the author of over 120 peer-reviewed publications, mostly dealing with interventional rheumatology,

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