Introduction to Musculoskeletal Ultrasound
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Getting Started

JEFFREY A. STRAKOWSKI, MD

Clinical Associate Professor
Department of Physical Medicine and Rehabilitation
Ohio State University School of Medicine
Columbus, Ohio

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To my family—Danielle, Nathan, Devin, and Hannah for their love, support, and tolerance.

Also to my residents whose excitement for learning helped inspire the creation of the book.
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Preface

The use of high frequency ultrasound as an imaging modality for the musculoskeletal system has expanded dramatically in the past decade. Technological advancements have led to progressively improving image resolution and a broader scope of applications. The value of ultrasound in improving diagnostic acumen and safety and accuracy in dynamic guidance of interventional procedures has resulted in increased use in musculoskeletal clinics.

Despite its growth, standardized training for use of this modality is not yet available in the majority of residency training programs. The number of qualified instructors has increased over the years, leading to the speculation that formal instruction in musculoskeletal ultrasound will develop in both residencies and medical schools. The increasing recognition of its value has also resulted in more education in musculoskeletal ultrasound for sonographers.

This text was written in an effort to illustrate and teach the basic components of many of the skills and knowledge needed to begin incorporating the use of ultrasound in a musculoskeletal practice. A concern often expressed by both my resident physicians and established practitioners who attended our didactic courses was that attempting to get started was very intimidating. They often cited that learning the skills needed to operate the equipment and obtain and interpret the images appears too daunting and that many of the available courses and texts initially appear too advanced.

The goal of this book is to provide a simplified approach for those getting started in musculoskeletal ultrasound. This includes developing understanding in use of the controls and function of the ultrasound
machine, commonly used terminology, obtaining and optimizing the image, and proper scanning technique. It also is designed to instruct in the recognition of the appearance of various musculoskeletal tissue, commonly seen artifacts, foreign bodies and masses, and understanding basics of interventional ultrasound. Principles of further advancement of skills and initiating a practice are also discussed. The chapters contain concise instructional concepts, a large number of illustrations to assist with understanding, and helpful reminders summarizing the key educational points.

It has been exciting to watch the growth of interest in this field. It is my hope that this text can help beginners make the first steps into the rapidly growing knowledge base of musculoskeletal ultrasound and ultimately develop more advanced learning and progression of skills.

Jeffrey A. Strakowski, MD
I would like to thank the physicians and staff at Physical Medicine Associates and the McConnell Spine, Sport and Joint Center, and the residents and faculty in the department of Physical Medicine and Rehabilitation at The Ohio State University for their support in this work.

I would also like to acknowledge General Electric, Sonosite, and CAE Health Care whose products were used in the creation of many of the images.
CHAPTER

Introduction

The decision to get started in the discipline of musculoskeletal ultrasound is not an easy one. Individuals embarking on this endeavor often have no prior experience in the use of ultrasound and understanding the images and instrumentation can be daunting. This is coupled with the fact that there is often no standardized training available and considerable academic rigor is needed to develop proficiency in the use of ultrasound of the musculoskeletal system.

Ultrasound has become an increasingly popular tool for visualizing soft tissue in all areas of medicine. It provides a number of advantages over other imaging modalities. It provides real-time imaging that does not rely on ionizing radiation and can be used in the presence of metallic implants. There are no issues with claustrophobia and no reliance on immobile-imaging centers. There are no known adverse effects with the use of diagnostic ultrasound and therefore, no specific restrictions. Additional advantages of ultrasound include dynamic visualization with the ability to see moving tissue. This can be invaluable in circumstances where dynamic abnormalities might go unrecognized in static images. Doppler imaging is also available on most ultrasound machines, which allows real-time assessment of vascular flow. This is valuable when assessing both normal and pathologic vascularity.

Ultrasound is an ideal modality for needle guidance for many diagnostic and therapeutic procedures. It allows real-time visualization of needle motion in conjunction with the target and surrounding soft tissue structures. Acquiring needle guidance skills with ultrasound can greatly enhance safety and accuracy with needle procedures.
The development of high-resolution broadband high-frequency transducers has led to vast improvements in visualization of the relatively superficial structures in the musculoskeletal system. As a result, ultrasound can provide information not always available with other imaging modalities. The acumen provided by this information can be beneficial to any musculoskeletal practice. The relatively low cost, portability, and instant feedback of results also greatly enhances patient satisfaction.

Once the decision is made to develop skills in high-frequency ultrasound, a plan is needed for obtaining appropriate equipment and learning how to use it. Currently, there are limited formal training programs for musculoskeletal ultrasound in residency. Online instruction is available; however, there is no replacement for hands-on instruction. This can be found in many courses offered around the country and world. The current trends suggest that there will be an increase in learning opportunities in medical schools and residency programs.

As with any skill, many hours of practice are needed to develop proficiency. An examiner needs familiarity with the instrumentation and image optimization as well as proper scanning techniques and ergonomics. Recognition of characteristic tissue appearance and their changes in pathologic conditions is required to perform a competent musculoskeletal ultrasound examination. Knowledge of artifacts and minimizing their impact on the image is also necessary.

Incorporation of ultrasound into clinical practice is also challenging. It is particularly daunting for individuals already beyond their formal training and in established practice. Greater resources are becoming available to assist with education and skill development, clinical competency, and coding and billing. It takes the development of a substantial knowledge base and countless hours of practice to perform effective musculoskeletal ultrasound, but the results can be greatly rewarding.