American Medical Society for Sports Medicine
Sports Ultrasound Curriculum for Sports Medicine Fellowships

Mederic M. Hall, MD,* David T. Bernhardt, MD,† Jonathan T. Finnoff, DO,‡ Douglas F. Hoffman, MD,§ Melody R. Hrubes, MD,¶ Kenneth R. Mautner, MD,‖ Ashwin L. Rao, MD,** Jeremiah W. Ray, MD,†† Jay Smith, MD,‡‡ and Anna L. Waterbrook, MD§§

Abstract: Sports ultrasound is commonly used by sports medicine physicians to enhance diagnostic and procedural accuracy. This expert consensus statement serves as an update to the 2015 American Medical Society for Sports Medicine recommended sports ultrasound curriculum for sports medicine fellowships. Although written in the context of the American sports medicine fellowship training model, we present a stepwise progression in both diagnostic and interventional sports ultrasound that may be applicable to the broader sports medicine community. The curriculum is divided into 12 units with each unit including didactic instructional sessions, practical hands-on instruction, independent scanning practice sessions, and mentored clinical experience. To assist with prioritization of learning, we have organized relevant pathology and procedures as essential, desirable, and optional. The expanded content can serve as an outline for continuing education postfellowship or for any physician to further advance their sports ultrasound knowledge and skill. We also provide updated scanning protocols, sample milestones, and a sample objective structured clinical examination (OSCE) to aid fellowships with implementation of the curriculum and ongoing assessment of fellow progress.

Key Words: ultrasound

INTRODUCTION

The American Medical Society for Sports Medicine (AMSSM) developed a recommended musculoskeletal ultrasound curriculum for sports medicine fellows in 2010. The curriculum was revised in 2015 and the term sports ultrasound (Sports US) was introduced to reflect the use of ultrasound by sports medicine physicians for both musculoskeletal and nonmusculoskeletal applications. Since that time, Sports US has become nearly ubiquitous in sports medicine clinics, training rooms, and at sporting events throughout the United States of America. In 2017, ultrasound training was formally added to the Accreditation Council for Graduate Medical Education (ACGME) core program requirements for sports medicine fellowships, solidifying the importance of ultrasound as a diagnostic and procedural tool for the sports medicine physician. This current revision recognizes the ongoing evolution of Sports US in practice and aims to provide updated training guidelines to ensure that sports medicine fellows are prepared to integrate Sports US successfully into their practice on completion of fellowship.

Working Group Selection and Process

The AMSSM Sports Ultrasound Committee Chair (M.M.H.) was tasked with assembling a working group to review the 2015 curriculum and provide updates as needed. An expert panel was carefully selected to include diversity of primary specialty (emergency medicine, family medicine, pediatrics, and physical medicine and rehabilitation) and significant experience in both fellowship education and the clinical applications of Sports US. The group was approved by the AMSSM Board of Directors.

The prior curricula were reviewed by the entire panel and opportunities for improvements were identified. Similar curricula from other specialty societies also were reviewed.
Informal feedback was requested during AMSSM Sports Ultrasound Committee meetings and through electronic communications from both fellowship directors and prior/current fellows. The group was then divided into smaller working groups to address individual sections. These groups reviewed the key literature and developed a working outline which was brought to the larger group for discussion. Consensus was reached in all areas with every member of the panel approving the final recommended curriculum.

Key Updates

Several notable changes have been made to the curriculum. First, the scanning protocols have been updated and provide an educational/instructional tool to assist with familiarization of regional anatomy relevant to the practice of sports medicine (see Appendix 1, Supplemental Digital Content 1, http://links.lww.com/JSM/A270). Sports medicine fellows should strive to become competent in the scanning techniques and normal anatomy listed. Although not meant to be prescriptive for clinical practice, see Appendix 1, Supplemental Digital Content 1, http://links.lww.com/JSM/A270 is organized to facilitate identification of structures needed for a complete regional ultrasound examination. Structures listed as required should be prioritized during the learning process and strongly considered when performing a complete regional examination. The optional structures often will be included in addition to the required structures based on the specific clinical question or independently as part of a focused limited examination.

In addition, the concept of core competencies has been replaced. We now characterize individual pathologies and procedures as essential, desirable, or optional. Essential pathology and procedures should be prioritized during the sports medicine fellowship as they are integral to the practice of sports medicine. Desirable pathology and procedures are those that may be less common or more advanced but are of significant importance to the sports medicine physician. These should be introduced after the fellow becomes competent in the essential concepts. Finally, optional pathology and procedures have been detailed to serve as aspirational content recognizing that many of these concepts will require continued learning beyond fellowship training. This applies to the optional structures listed in the scanning protocols as well. The fundamentals, however, should be in place for all sports medicine physicians to develop these skills.

Another significant change to this curriculum is the formal inclusion of Sports US evaluation of acute trauma. Although the previous curriculum introduced nonmusculoskeletal applications such as the FAST (Focused Assessment with Sonography for Trauma) examination, only musculoskeletal core competencies were included in the curriculum. In this article, we include a practical curriculum in applications and protocols relevant to sports medicine practice in the field. With the increasing availability of on-site ultrasound capabilities, these applications have moved beyond theoretical and are now being actively used by many sports medicine physicians to provide prompt diagnosis and aid in critical decision-making. Although the role of ultrasound in evaluation and management of acute trauma continues to be defined in sports medicine practice, these concepts are supported in the Emergency Medicine and Critical Care literature.

Finally, in keeping with recent developments in graduate medical education, we have provided suggested milestones (see Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271) to aid in the evaluation of fellow progression and competency in Sports US. These milestones now recognize not only the importance of identifying pathology and performing procedures, but also generating a detailed and accurate report. Appropriate reporting of diagnostic findings and procedural details is an essential skill and has been integrated into the curriculum. A sample objective structured clinical examination (OSCE) is also included (see Appendix 3, Supplemental Digital Content 3, http://links.lww.com/JSM/A272).

OVERVIEW OF CURRICULUM STRUCTURE

The curriculum has been organized into 12 units as presented in Table 1. Each unit follows a general progression beginning with introduction of core concepts followed by progression of skills in acquiring and interpreting diagnostic images and finally interventional procedural techniques. The core components of the curriculum continue to be: (1) didactic instructional sessions, (2) didactic practical hands-on instruction, (3) supplementary education, and (4) mentored clinical experience.

Didactic Instructional Sessions

Didactic instruction can occur by a dedicated Sports US course or scheduled teaching sessions during fellowship. Multiple online resources have been developed to assist programs in meeting this requirement and can be found on the AMSSM website (https://www.amssm.org/). Each fellowship program is encouraged to provide the fellow with further pertinent information relevant to each educational unit. Some online resources are provided in Supplemental Digital Content 4 (see Appendix 4, http://links.lww.com/JSM/A273).

Unit 1 includes introductory lectures discussing ultrasound principles and physics, image acquisition and optimization, normal and pathologic appearance of tissues, ultrasound artifacts, advantages and limitations of ultrasound relative to other imaging modalities, appropriate labeling and reporting, coding and billing, and appropriate ultrasound unit maintenance and cleaning. Unit 2 reviews pharmacological principles of commonly used medications, patient selection, sterile technique, ergonomics, procedural risks and treatment of common adverse events, and introduces the techniques of ultrasound-guided interventional image optimization and needle/device dynamic tracking using both in-plane and out-of-plane techniques. Unit 3 introduces the topic of Sports US evaluation of acute trauma. This topic may be less familiar to some fellows and faculty. Programs may consider partnering with emergency medicine colleagues as needed; online resources are being developed for the AMSSM website (https://www.amssm.org/). Didactic instruction should introduce trauma scanning techniques/protocols and review indications, limitations, and the importance of repeat examinations and complimentary advanced imaging.

The remaining units are divided by the body region, and the didactic instructional sessions are organized into 3 sections to facilitate a stepwise learning progression: (1) review of scanning protocols and normal anatomy, (2) relevant regional pathology, and (3) ultrasound-guided interventional...
Table 1. Sports Ultrasound Curriculum Outline†

| 1. Principles of sports ultrasound and introduction to diagnostic scanning techniques |
| 2. Introduction to ultrasound-guided interventional procedures |
| 3. Sports ultrasound evaluation of trauma and other acute conditions |
| 4. Sports ultrasound of the shoulder (including the neck, chest, and upper arm as indicated) |
| 5. Sports ultrasound of the elbow and forearm |
| 6. Sports ultrasound of the wrist |
| 7. Sports ultrasound of the hand and finger |
| 8. Sports ultrasound of the hip and pelvis |
| 9. Sports ultrasound of the thigh |
| 10. Sports ultrasound of the knee |
| 11. Sports ultrasound of the leg and ankle |
| 12. Sports ultrasound of the foot |

* Each unit includes (1) didactic instructional sessions, (2) didactic practical hands-on instruction, (3) supplementary educational activities including independent scanning practice sessions, and (4) mentored clinical experience.

† Units 4 to 12 are organized to facilitate a stepwise learning progression: (1) review of scanning protocols and normal anatomy, (2) relevant regional pathology, and (3) ultrasound-guided interventional procedures associated with the region. Proceed to the diagnostic scanning protocol of the shoulder).

**Didactic Practical Hands-On Instruction**

Hands-on didactic practice sessions should be completed under the direct supervision of a qualified mentor. A qualified mentor is defined as an individual who has completed an accredited sports medicine fellowship since the addition of ultrasound to the ACGME core program requirements and/or who has met the qualifications outlined by the American Institute of Ultrasound in Medicine (AIUM) Training Guidelines (https://www.aium.org/). During these sessions, fellows should apply the knowledge and skills acquired during the didactic instructional sessions in a controlled and supervised environment.

The didactic practical hands-on sessions should include the following: (1) practice and demonstration of performing a complete ultrasound evaluation of each region listed in the scanning protocols including proper image optimization and acquisition (see Appendix 1, Supplemental Digital Content 1, http://links.lww.com/JSM/A270); (2) practice and demonstration of proper image labeling and storage. Transfer of images should follow guidelines outlined by the Health Insurance Portability and Accountability Act; (3) review of saved images from the fellow’s self-directed practice scanning sessions and provision of constructive feedback regarding study completeness, proper image optimization, labeling, storage, and transfer. Deficiencies should be reconciled during subsequent scanning sessions; (4) practice and demonstration of interventional skills, preferably using unembalmed cadaveric specimens. If cadaveric specimens are not available, the fellow should practice appropriate imaging of target structures on live models and should practice needle/device imaging and guidance techniques using turkey breasts, pig feet, pig legs, firm tofu, phantoms, or another appropriate medium. As the fellow’s skills improve, more advanced Sports US examination techniques and interventional procedures should be introduced into the didactic practice sessions (see desirable and optional categories below).

**Supplementary Education**

The fellow’s education should include supplementary educational experiences to reinforce the knowledge and skills gained during the didactic sessions and mentored clinical experience. Independent scanning practice sessions are required, and their importance should be stressed. It is only through regular scanning that proficient technique can be achieved. These sessions should include obtaining normal complete regional scans for review with the fellow’s mentor. During these sessions, the fellow should also practice positioning for procedures and ultrasound-guided needle/device tracking using the appropriate medium as describe above.

Other recommended supplementary experiences include (1) utilizing online education material including the AMSSM Sports US Online Didactics, virtual meetings, and webinars; (2) reading reference texts and journal articles; (3) presenting Sports US–related articles at the journal club; and (4) attending live Sports US conferences and presentations. The integration of recommended supplementary educational experiences may vary from fellowship to fellowship based on available resources and the overall curriculum structure.

**Mentored Clinical Experience**

This component of the fellow’s Sports US training process is required to ensure that the fellow is proficient in performing the recommended diagnostic and interventional Sports US skills in clinical practice. As knowledge and skills are acquired through the didactic and independent scanning sessions, the fellow
should, under the direct supervision of a qualified mentor, begin to perform diagnostic scanning and interventional procedures on patients in a clinical setting. During this experience, fellows should practice and eventually demonstrate competency as described in the sample milestones (see Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271). Special attention should be paid to obtaining proficiency in performing all regional examinations, recognizing essential pathologic conditions, and performing essential interventional procedures. Once these skills are established, the fellow may progress through the desirable and optional pathology as well as interventional procedures as time and resources allow. As the fellow gains proficiency in the clinical applications of Sports US, the level of supervision may be modified as allowed by institutional policy governing teaching rules.

RECOMMENDED CURRICULUM AND LEARNING OBJECTIVES FOR SPORTS ULTRASOUND TRAINING

The following curriculum has been organized into units. Suggested resources and references have been grouped at the end of the curriculum and are available on the AMSSM website (https://www.amssm.org/). Although the curriculum should be believed of as fluid and longitudinal throughout the year, introductory Units 1 and 2 should be completed first and prioritized early in the fellowship year. Unit 3 may also be considered earlier in the fellowship year given the increased likelihood of trauma and other acute conditions during contact and collision sports that are more common in the fall. The order of the remaining units may be modified as needed and will likely be taught concurrently as the fellow progresses from essential to desirable to optional content. We strongly recommend, however, achieving diagnostic proficiency of a specific region before progressing to interventional procedures for that region. Fellows should not be taught to put a needle or other device through a structure they cannot name and readily identify.

Given the unpredictable nature of acute trauma in sport and variance in presentation of specific conditions, we recognize that it may not be feasible for fellows to acquire multiple images of the pathologic state for each of the recommended units. The minimum requirement should include hands on instruction in the scanning protocols and independent normal scans submitted for review. Becoming familiar with the absence of pathology is essential. Fellowship programs could consider partnering outside of the traditional sports medicine and primary specialty clinics as needed for exposure to relevant examples of pathologic studies. This could include the emergency department, orthopedic and rheumatology clinics, as well as medicine and intensive care wards. Every effort should be made to ensure that fellows achieve competence in the core concepts represented by the essential pathology and procedures listed below.

This curriculum allows flexibility for programs that have varying prioritization of ultrasound training in their overall fellowship curriculum. This flexibility will fulfill ACGME program requirements, AIUM training guidelines, and prerequisites for the Alliance for Physician Certification & Advancement Registered in Musculoskeletal sonography certification. Successful completion will ensure the acquisition of enough Sports US skills to allow independent practice in diagnostic and interventional Sports US.

UNIT 1: PRINCIPLES OF SPORTS ULTRASOUND AND INTRODUCTION TO DIAGNOSTIC SCANNING TECHNIQUES

1. Didactic Instructional Sessions
   a. Identify and discuss the function of basic controls on an ultrasound machine console, including:
      i. Transducer selection
      ii. Presets
      iii. Depth
   b. Instruction on basic ultrasound physics, including:
      i. How an ultrasound image is generated
      ii. Inter-relationship of machine controls (eg, frequency, resolution, and depth)
      iii. Doppler imaging (difference between power Doppler and color Doppler)
      c. Discuss how to optimize an ultrasound image
         i. Superficial structures
         ii. Deep structures
   d. Discuss the benefits and limitations of ultrasound relative to other imaging modalities
   e. Understand the use of Doppler for imaging vascular structures including neovessels
   f. Describe transducers movements
      i. Slide
      ii. Heel-toe
      iii. Heel-toe
   g. Describe the normal ultrasound appearance of bone, cartilage, ligament, fascia, fat, muscle, nerve, tendon, thoracoabdominal structures, and vasculature
   h. Discuss the common abnormal ultrasound appearances of bone, cartilage, ligament, fascia, fat, muscle, nerve, tendon, thoracoabdominal structures, and vasculature
   i. Identify and discuss the source and/or implications of ultrasound artifacts, including:
      i. Acoustic shadowing
      ii. Anisotropy
      iii. Through transmission
      iv. Refraction
      v. Reverberation
      j. Describe appropriate labeling of ultrasound images
         i. Use of text insertion and arrows
         ii. Appropriate use of measurement calipers
   k. Understand how to capture, store, and transfer ultrasound images
   l. Discuss use of appropriate terminology
   m. Discuss appropriate diagnostic reporting and coding/billing per institutional guidelines
   n. Understand appropriate ultrasound maintenance and transducer cleaning/disinfection

2. Didactic practical hands-on instruction
   a. Introduction to the ultrasound cart
   b. Review of institutional ultrasound procedure room policies and protocols
c. Demonstration of basic scanning techniques including image optimization, transducer movements, patient and physician ergonomics, etc.

UNIT 2: INTRODUCTION TO ULTRASOUND-GUIDED INTERVENTIONAL PROCEDURES

1. Didactic instructional sessions
   a. Understand the rationale for ultrasound-guided procedures
      i. Indications
      ii. Contraindications
   b. Describe appropriate labeling of ultrasound interventional images
   c. Understand how to capture, store, and transfer ultrasound procedure images
   d. Discuss use of appropriate procedural terminology
   e. Discuss appropriate procedural reporting
   f. Understand coding and billing guidelines including requirements for image archiving
   g. Discuss general principles of ultrasound-guided procedures
      i. Patient selection
      ii. Ergonomics
      iii. Sterile technique
      iv. Describe the advantages and disadvantages of needle tracking using an in-plane versus out-of-plane approach and provide clinical examples of when each approach may be beneficial
      v. Understand image optimization for needle location, relocation, and dynamic tracking, including transducer manipulation, jiggling, rotation, and styllet movement
   2. Didactic practical hands-on instruction
      a. Image a needle using an in-plane and out-of-plane approach under ultrasound guidance in a phantom, turkey breast, cadaveric specimen, or other imaging medium
      b. Demonstrate the ability to efficiently relocate a lost needle during both an in-plane and out-of-plane needle tracking approach
      c. Demonstrate the ability to guide a needle into a target region or structure using both an in-plane and out-of-plane approach in a phantom, turkey breast, cadaveric specimen, or other imaging medium

UNIT 3: SPORTS ULTRASOUND EVALUATION OF TRAUMA AND OTHER ACUTE CONDITIONS

1. Didactic instructional sessions
   a. The rationale for ultrasound assessment of the acutely injured athlete
   b. Limitations of ultrasound in the setting of acute trauma
   c. Indications for repeat ultrasound examinations or complimentary advanced imaging
   d. Specific applications and techniques
      i. General principles of fracture and dislocation evaluation
      ii. Skin and soft tissue (including foreign body identification and differentiation of cellulitis from abscess)
      iii. Thoracoabdominal trauma
      iv. Introduction to vascular ultrasound (venous thrombosis)
      v. Ocular trauma
      vi. Collapsed athlete
      vii. Shortness of breath/pulmonary evaluation
   2. Didactic practical hands-on instruction
      a. Hands-on instruction in diagnostic scanning protocols
      b. Supervised practice of diagnostic scanning protocols
         i. Appropriate patient positioning
         ii. Transducer selection
         iii. Ergonomics
         iv. Technique
   3. Supplementary education and mentored clinical experience
      a. Independent examinations. (3 separate normal scans demonstrating the structures and protocols from Supplemental Digital Content 1, http://links.lww.com/JSM/A270) are to be submitted to the mentor for review; see Milestones Level 2, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      b. Essential pathology and protocols (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
         i. Common sites of fracture
            1. Rib
            2. Clavicle
            3. Distal radius/ulna
            4. Metacarpal
            5. Fibula
            6. Metatarsal
         ii. Glenohumeral joint dislocation
         iii. Phalangeal dislocation
         iv. eFAST (extended Focused Assessment of Sonography in Trauma)
         v. Differentiation of cellulitis from abscess
         vi. Identification of superficial foreign body
      c. Desirable pathology and protocols (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
         i. Scaphoid fracture
         ii. Other long bone fractures
         iii. Ocular trauma assessment
         iv. RUSH (rapid ultrasound in hypotension)
      d. Optional pathology and protocols (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
         i. Other nonlong bone extremity fractures
         ii. Other joint dislocation
         iii. Identification of superficial and deep venous thrombosis
         iv. Pulmonary assessment
         v. Limited cardiac assessment for evaluation of pericardial effusion and global systolic function

UNIT 4: SPORTS ULTRASOUND OF THE SHOULDER (INCLUDING THE NECK, CHEST, AND UPPER ARM AS INDICATED)

1. Didactic instructional sessions
   a. Review scanning protocols and online live scanning demos
   b. Pathology lectures
   c. Procedures lectures
   2. Didactic practical hands-on instruction
      a. Hands-on instruction in diagnostic scanning protocols and procedural technique
      b. Supervised practice of diagnostic scanning protocols and procedural image acquisition
i. Appropriate patient positioning
ii. Transducer selection
iii. Ergonomics
iv. Technique
c. As resources allow, it is recommended that ultrasound-guided procedures be practiced on an unembalmed cadaveric specimen. If this is not feasible, then fellows should practice all aspects of needle visualization and tracking using other appropriate medium. The principles of the procedures listed below should be reviewed in a formal didactic setting.
3. Supplementary education and mentored clinical experience
a. Independent complete regional examinations. (3 separate normal scans are to be submitted to the mentor for review; see Milestones Level 2, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Subacromial–subdeltoid bursitis
   ii. Subacromial impingement (at acromion or coracoacromial ligament)
   iii. Rotator cuff tendinosis
   iv. Full thickness rotator cuff tear
   v. Long head of the biceps tendinopathy
   vi. Glenohumeral joint effusion and/or synovitis
   vii. Acromioclavicular joint osteoarthritis
   viii. Acromioclavicular joint sprain
b. Essential pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Subacromial–subdeltoid bursitis
   ii. Subacromial impingement (at acromion or coracoacromial ligament)
   iii. Tenotomy with or without debridement of rotator cuff
   iv. Full thickness rotator cuff tear
   v. Long head of the biceps tendinopathy
   vi. Glenohumeral joint effusion and/or synovitis
   vii. Acromioclavicular joint osteoarthritis
   viii. Acromioclavicular joint sprain
c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Intra-articular glenohumeral joint aspiration/injection
   ii. Intra-articular acromioclavicular joint injection
   iii. Subacromial–subdeltoid bursa injection
   iv. Biceps tendon sheath injection
d. Desirable pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Long head of biceps subluxation/dislocation
   ii. Rotator cuff partial thickness tear
   iii. Spinoglenoid notch cyst
   iv. Fatty infiltration and/or atrophy of the rotator cuff muscles
   v. Pectoralis major muscle and/or tendon tear
e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Barbotage of calcific tendinopathy
   ii. Rotator interval approach to glenohumeral joint injection
f. Optional pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Adhesive capsulitis (ie, coracoacromial ligament thickening, hyperemia, etc.)
   ii. Subcoracoid impingement
   iii. Radial neuropathy
iv. Axillary neuropathy (eg, quadrilateral space syndrome, post-traumatic, etc.)
   v. Brachial plexopathy
   vi. Sternoclavicular joint osteoarthritis
   vii. Sternoclavicular joint effusion and/or synovitis
   viii. Sternoclavicular joint sprain with or without instability
g. Optional procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Suprascapular nerve block
   ii. Sternoclavicular joint aspiration/injection
   iii. Tenotomy with or without debridement of rotator cuff

UNIT 5: SPORTS ULTRASOUND OF THE ELBOW AND FOREARM
1. Didactic instructional sessions
   a. Review scanning protocols and online live scanning demos
   b. Pathology lectures
   c. Procedures lectures
2. Didactic practical hands-on Instruction
   a. Hands-on instruction in diagnostic scanning protocols and procedural technique
   b. Supervised practice of diagnostic scanning protocols and procedural image acquisition
      i. Appropriate patient positioning
      ii. Transducer selection
      iii. Ergonomics
      iv. Technique
c. As resources allow, it is recommended that ultrasound-guided procedures be practiced on an unembalmed cadaveric specimen. If this is not feasible, then fellows should practice all aspects of needle visualization and tracking using other appropriate medium. The principles of the procedures listed below should be reviewed in a formal didactic setting.
3. Supplementary education and mentored clinical experience
a. Independent complete regional examinations (3 separate normal scans should be submitted for review; see Milestones Level 2, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Common extensor tendonopathy
   ii. Common flexor tendonopathy
   iii. Ulnar collateral ligament injury with or without instability
   iv. Ulnar neuropathy at the elbow with or without instability
c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Intra-articular elbow joint aspiration/injection
   ii. Peritendinous or intratendinous injection of the common extensor tendon origin
iii. Peritendinous or intratendinous injection of the common flexor tendon origin

d. Desirable pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Distal biceps tendinopathy
   ii. Triceps tendinopathy
   iii. Elbow joint osteoarthritis
   iv. Radial head or neck fracture
   v. Elbow joint effusion and/or synovitis
   vi. Posterior interosseous nerve entrapment
   vii. Lateral collateral ligament complex injury with or without instability
   viii. Posterior impingement of the elbow
   ix. Olecranon bursitis

e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Distal biceps peritendinous injection/bicipitoradial bursa injection
   ii. Posterior interosseous nerve block/perineural injection
   iii. Tenotomy with or without debridement elbow tendon

f. Optional pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Bicipitoradial bursitis
   ii. Median nerve entrapment at the elbow
   iii. Posterolateral rotary instability
   iv. Olecranon fossa synovitis
   v. Posterolateral impingement (elbow synovial fold syndrome)

g. Optional procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   i. Ulnar nerve block/perineural injection
   ii. Median nerve block/perineural injection

UNIT 6: SPORTS ULTRASOUND OF THE WRIST

1. Didactic instructional sessions
   a. Review scanning protocols and online live scanning demos
   b. Pathology lectures
   c. Procedures lectures

2. Didactic practical hands-on instruction
   a. Hands-on instruction in diagnostic scanning protocols and procedural technique
   b. Supervised practice of diagnostic scanning protocols and procedural image acquisition
      i. Appropriate patient positioning
      ii. Transducer selection
      iii. Ergonomics
      iv. Technique
   c. As resources allow, it is recommended that ultrasound-guided procedures be practiced on an unembalmed cadaveric specimen. If this is not feasible, then fellows should practice all aspects of needle visualization and tracking using other appropriate medium. The principles of the procedures listed below should be reviewed in a formal didactic setting.

3. Supplementary Education and Mentored Clinical Experience
   a. Independent complete regional examinations (3 separate normal scans should be submitted for review; see Milestones Level 2, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   b. Essential pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Wrist joint effusion and/or synovitis
      ii. Stenosing tenosynovitis of first dorsal compartment (DeQuervain’s tenosynovitis)
      iii. Median neuropathy at the wrist (carpal tunnel syndrome)
      iv. First carpometacarpal joint osteoarthritis
      v. Dorsal or volar ganglion cyst
   c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Intra-articular wrist aspiration/injection
      ii. First carpometacarpal joint injection
      iii. Wrist tendon sheath injection
      iv. Carpal tunnel injection
   d. Desirable pathology (Demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Dorsal scapholunate ligament sprain with or without instability
      ii. Extensor carpi ulnaris tendinopathy with or without instability
      iii. Extensor tenosynovitis
      iv. Flexor carpi radialis tendinopathy
      v. Flexor carpi ulnaris enthesopathy
      vi. Scaphoid fracture
      vii. Distal radius or ulna fracture
   e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Proximal and distal intersection syndromes
      ii. Fourth dorsal compartment retinacular impingement
      iii. Metacarpal bossing
      iv. Pisotriquetral osteoarthritis
      v. Ulnar nerve entrapment at Guyon’s canal (eg, accessory abductor digitii minimi muscle)
      vi. Triangular fibrocartilage complex tear
      vii. Hook of the hamate fracture
   f. Optional procedures (demonstrative cases should be submitted for review, including draft reports; see
UNIT 7: SPORTS ULTRASOUND OF THE HAND AND FINGER

1. Didactic instructional sessions
   a. Review scanning protocols and online live scanning demos
   b. Pathology lectures
   c. Procedures lectures

2. Didactic practical hands-on instruction
   a. Hands-on instruction in diagnostic scanning protocols and procedural technique
   b. Supervised practice of diagnostic scanning protocols and procedural image acquisition
      i. Appropriate patient positioning
      ii. Transducer selection
      iii. Ergonomics
      iv. Technique
   c. As resources allow, it is recommended that ultrasound-guided procedures be practiced on an unembalmed cadaveric specimen. If this is not feasible, then fellows should practice all aspects of needle visualization and tracking using other appropriate medium. The principles of the procedures listed below should be reviewed in a formal didactic setting.

3. Supplementary education and mentored clinical experience
   a. Independent complete regional examinations (3 separate normal scans should be submitted for review; see Milestones Level 2, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   b. Essential pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Metacarpal joint effusion and/or synovitis
      ii. Flexor tendon stenosing tenosynovitis (trigger finger)
      iii. Ulnar collateral ligament sprain of the first metacarpophalangeal (MCP) joint with or without instability
      iv. Metacarpal fracture
   c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Intra-articular finger joint aspiration/injection
      ii. Flexor tendon sheath injection
   d. Desirable pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Sagittal band injury with or without instability
      ii. Central slip injury
      iii. Terminal extensor tendon injury (Mallet finger)
      iv. Flexor digitorum profundus tendon tear (Jersey finger)
      v. Phalanx dislocation
      vi. Volar plate injury
      vii. Proximal interphalangeal joint collateral ligament injury
   e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. A2 and A4 pulley tears (rock climber’s finger)
      ii. Second–fifth MCP joint collateral ligament injury
   f. Optional pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Ganglion cyst aspiration/injection
   g. Optional procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Trigger finger release

UNIT 8: SPORTS ULTRASOUND OF THE HIP AND PELVIS

1. Didactic instructional sessions
   a. Review scanning protocols and online live scanning demos
   b. Pathology lectures
   c. Procedures lectures

2. Didactic practical hands-on instruction
   a. Hands-on instruction in diagnostic scanning protocols and procedural technique
   b. Supervised practice of diagnostic scanning protocols and procedural image acquisition
      i. Appropriate patient positioning
      ii. Transducer selection
      iii. Ergonomics
      iv. Technique
   c. As resources allow, it is recommended that ultrasound-guided procedures be practiced on an unembalmed cadaveric specimen. If this is not feasible, then fellows should practice all aspects of needle visualization and tracking using other appropriate medium. The principles of the procedures listed below should be reviewed in a formal didactic setting.

3. Supplementary education and mentored clinical experience
   a. Independent complete regional examinations (3 separate normal scans should be submitted for review; see Milestones Level 2, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   b. Essential pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Intra-articular finger joint aspiration/injection
      ii. Flexor tendon sheath injection
   c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Adductor tendinopathy
      ii. Hip joint effusion and/or synovitis
      iii. Iliopsoas tendinopathy and/or bursitis with or without snapping
      iv. Gluteus medius/minimus tendinopathy
      v. Greater trochanteric (subgluteus maximus) bursitis
      vi. Proximal hamstring tendinopathy
   c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see
UNIT 9: SPORTS ULTRASOUND OF THE THIGH

1. Didactic instructional sessions
   a. Review scanning protocols and online live scanning demos
   b. Pathology lectures
   c. Procedures lectures

2. Didactic practical hands-on instruction
   a. Hands-on instruction in diagnostic scanning protocols and procedural technique
   b. Supervised practice of diagnostic scanning protocols and procedural image acquisition

3. Supplementary education and mentored clinical experience
   a. Independent complete regional examinations (3 separate normal scans should be submitted for review; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   b. Essential pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   c. Desirable pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   d. Optional pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

UNIT 9: SPORTS ULTRASOUND OF THE THIGH


i. Intra-articular hip aspiration/injection
ii. Greater trochanteric bursa injection
iii. Proximal hamstring peritendinous or intra-tendinous injection
d. Desirable pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Distal rectus abdominus tendinopathy and/or aponeurosis tear
ii. Rectus femoris tendinopathy
iii. Anterior acetabular labral tear
iv. Osteitis pubis
v. Adductor longus muscle/tendon tear
vi. Gluteus medius/minimus tendon tear
vii. Morel–Lavallee lesion in the hip region
viii. Proximal hamstring tendon tear
ix. Proximal iliobibial band origin enthesopathy
e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Lioptosia sarsura injection
ii. Gluteus medius or minimus peritendinous or intra-tendinous injection
iii. Adductor longus tendon origin peritendinous or intratendinous injection
f. Optional pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Hip impingement (eg, Cam lesion)
ii. Sartorius tendinopathy
iii. Tensor fascia latae tendinopathy
iv. Neuropathy of lateral cutaneous nerve of the thigh
v. Ischiofemoral impingement
vi. Transversalis fascia tear or insufficiency (“sports hernia”)
vi. Inguinal and/or femoral hernia

i. Heterotopic ossification in thigh musculature
ii. Morel–Lavallee lesion in the thigh region
iii. Grading severity of hamstring and quadriceps muscle injury
e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Aspiration/injection of fluid collection (ie, hematoma, Morel–Lavallee)
d. Desirable pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Hamstring muscle tear
ii. Quadriceps muscle tear
iii. Quadriceps contusion
c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Aspiration/injection of fluid collection (ie, hematoma, Morel–Lavallee)

UNIT 10: SPORTS ULTRASOUND OF THE KNEE

1. Didactic instructional sessions
a. Review scanning protocols and online live scanning demos
b. Pathology lectures
c. Procedures lectures

2. Didactic practical hands-on instruction
   a. Hands-on instruction in diagnostic scanning protocols and procedural technique
   b. Supervised practice of diagnostic scanning protocols and procedural image acquisition
      i. Appropriate patient positioning
      ii. Transducer selection
      iii. Ergonomics
      iv. Technique
   c. As resources allow, it is recommended that ultrasound-guided procedures be practiced on an unembalmed cadaveric specimen. If this is not feasible, then fellows should practice all aspects of needle visualization and tracking using other appropriate medium. The principles of the procedures listed below should be reviewed in a formal didactic setting.

3. Supplementary education and mentored clinical experience
   a. Independent complete regional examinations (3 separate normal scans should be submitted for review; see Milestones Level 2, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
   b. Essential pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Knee joint effusion and/or synovitis
      ii. Knee osteoarthritis (medial and lateral compartment, femoral trochlear sulcus)
      iii. Extensor mechanism tendinopathy (quadriceps and patellar)
      iv. Prepatellar bursitis
      v. Iliotibial band tendinopathy and bursitis with or without snapping
      vi. Baker’s cyst
      vii. Medial (tibial) collateral ligament sprain with or without instability
   c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Intra-articular knee aspiration/injection
      ii. Iliotibial band/bursa (distal) injection
      iii. Baker’s cyst aspiration
   d. Desirable pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Deep and superficial infrapatellar bursitis
      ii. Osgood–Schlatter’s disease
      iii. Lateral (fibular) collateral ligament sprain with or without instability
      iv. Meniscal tear, parameniscal cysts, and/or meniscal extrusion with dynamic assessment
      v. Pes anserine tendinopathy and/or bursitis
   e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Knee tendon peritendinous or intratendinous injection
      ii. Pes anserine bursa injection
   f. Optional pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Distal biceps femoris tendinopathy
      ii. Semimembranosus tendinopathy
      iii. Popliteus tendinopathy
      iv. Proximal tibiofemoral joint osteoarthritis, ganglion, and/or instability
      v. Posterior cruciate ligament tear
      vi. Common fibular neuropathy
      vii. Cruciate ligament ganglion cysts
      viii. Popliteal artery entrapment syndrome
      ix. Medial collateral ligament bursitis
      x. Differentiating sprains/pathology of the superficial and deep (meniscotal and meniscofemoral) fibers of the medial collateral ligament
      xi. Medial patellofemoral ligament sprain with or without instability
      xii. Saphenous neuropathy (entrapment at the sartorius and gracilis tendons or of the infrapatellar branches)
      xiii. Hoffa’s fat pad impingement
   g. Optional procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
      i. Common fibular nerve block/perineural injection
      ii. Genicular nerve block/perineural injection
      iii. Tendon scraping of patellar tendon
      iv. Tenotomy with or without debridement for knee tendon

UNIT 11: SPORTS ULTRASOUND OF THE LEG AND ANKLE

1. Didactic instructional sessions
   a. Review scanning protocols and online live scanning demos
   b. Pathology lectures
   c. Procedures lectures

2. Didactic practical hands-on instruction
   a. Hands-on instruction in diagnostic scanning protocols and procedural technique
   b. Supervised practice of diagnostic scanning protocols and procedural image acquisition
      i. Appropriate patient positioning
      ii. Transducer selection
      iii. Ergonomics
      iv. Technique
   c. As resources allow, it is recommended that ultrasound-guided procedures be practiced on an unembalmed cadaveric specimen. If this is not feasible, then fellows should practice all aspects of needle visualization and tracking using other appropriate medium. The principles of the procedures listed below should be reviewed in a formal didactic setting.

3. Supplementary education and mentored clinical experience
   a. Independent complete regional examinations (3 separate normal scans should be submitted for review; see

b. Essential pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Midportion Achilles tendinopathy
ii. Insertional Achilles tendinopathy
iii. Ankle joint effusion and/or synovitis
iv. Anterior talofibular ligament sprain with or without instability
v. Anterior–inferior tibiofibular ligament sprain with or without instability
vi. Fibularis longus and brevis tendinopathy with or without instability and/or intrasheath subluxation
vii. Posterior tibialis tendinopathy
viii. Medial gastrocnemius muscle injury
c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Intra-articular tibiotalar joint aspiration/injection
ii. Ankle tendon peritendinous or intratendinous injection
d. Desirable pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Anterior tibialis tendinopathy
ii. Anterior ankle impingement
iii. Calcaneofibular ligament sprain with or without instability
iv. Retrocalcaneal and retro-Achilles/superficial/subcutaneous bursitis
v. Flexor hallucis longus tendinopathy
vi. Deltoid ligament sprain with or without instability
vii. Spring ligament sprain with or without instability
viii. Fibular fracture (stress fracture or acute fracture)
ix. Tibial stress fracture
x. Gastrocnemius or soleus injury (other than medial gastrocnemius)
e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Subtalar joint aspiration/injection
f. Optional pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Talar dome articular cartilage pathology
ii. Superficial fibular nerve entrapment
iii. Subtalar joint effusion and/or synovitis and/or osteoarthritis
iv. Sural neuropathy
v. Fibularis quartus identification
vi. Plantaris tendinopathy
vii. Tarsal tunnel syndrome (including tibial, medial plantar, lateral plantar, medial calcaneal, and inferior calcaneal (Baxter’s) nerve entrapment)
viii. Deep fibular neuropathy
ix. Posterior impingement
x. Anterior process of the calcaneus fracture
xi. Talocalcaneal and calcaneonavicular coalitions
xii. Bifurcate ligament injury
g. Optional procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Tibial nerve block/perineural injection
ii. Brisement of Achilles or another ankle tendon
iii. Tenotomy with or without debridement ankle tendon
iv. Tenotomy with or without debridement ankle tendon
v. Fasciotomy for chronic exertional compartment syndrome

UNIT 12: SPORTS ULTRASOUND OF THE FOOT

1. Didactic instructional sessions
a. Review scanning protocols and online live scanning demos
b. Pathology lectures
c. Procedures lectures

2. Didactic practical hands-on instruction
a. Hands-on instruction in diagnostic scanning protocols and procedural technique
b. Supervised practice of diagnostic scanning protocols and procedural image acquisition

- Appropriate patient positioning
- Transducer selection
- Ergonomics
- Technique

c. As resources allow, it is recommended that ultrasound-guided procedures be practiced on an unembalmed cadaveric specimen. If this is not feasible, then fellows should practice all aspects of needle visualization and tracking using other appropriate medium. The principles of the procedures listed below should be reviewed in a formal didactic setting.

3. Supplementary education and mentored clinical experience
a. Independent complete regional examinations (3 separate normal scans should be submitted for review; see Milestones Level 2, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

b. Essential pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Plantar fasciopathy
ii. Lisfranc ligament sprain with or without instability
iii. Metatarsophalangeal joint effusion and/or synovitis
iv. Midfoot joint(s) osteoarthritis

c. Essential procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 3, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Periplantar or intraplantar fascia injection
ii. First metatarsophalangeal joint aspiration/injection

d. Desirable pathology (demonstrative cases of each diagnosis should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).

i. Metatarsal fracture
ii. Plantar fibromatosis
iii. Morton’s neuroma and/or intermetatarsal bursitis
iv. Plantar plate disorders
v. Submetatarsal bursitis
vi. Metatarsophalangeal joint urate deposition disease
e. Desirable procedures (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 4, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
i. Midfoot joint aspiration/injection
ii. Other toe joint aspiration/injection
iii. Morton’s neuroma/intermetatarsal bursa injection
f. Optional pathology (demonstrative cases should be submitted for review, including draft reports; see Milestones Level 5, Appendix 2, Supplemental Digital Content 2, http://links.lww.com/JSM/A271).
i. Calcaneal stress fracture
ii. Inferior calcaneal (Baxter’s) neuropathy including evaluation of abductor digiti minimi muscle fatty infiltration and/or atrophy
iii. Tendinopathy at the knot of Henry
iv. Medial plantar neuropathy at the knot of Henry
v. Deep fibular neuropathy
vi. Neuropathy of medial plantar proper digital nerve (Joplin’s neurona)

CHALLENGES AND OPPORTUNITIES

We acknowledge that successful implementation and completion of this curriculum may present challenges. Our working group has extensive experience in Sports US clinical application and teaching, and this is reflected in the comprehensive nature of this curriculum. The AMSSM has placed significant emphasis on developing Sports US training, and we believe this expanded curriculum will provide a solid foundation for all sports medicine physicians while also guiding those interested to achieve an expert level.

As previously mentioned, advanced expertise may be difficult to achieve within the current 1-year fellowship structure. Ongoing skill development and progression through the optional components of the curriculum will likely occur over several years, and our intent is not that fellows complete the curriculum in its entirety during their 1-year clinical fellowship. We also acknowledge that some fellowship programs may not have the optimal resources in place including qualified faculty mentors and available equipment. Nonetheless, Sports US training has been an ACGME requirement since 2017, and multiple resources have been developed by AMSSM that are freely available to assist programs in implementing the curriculum.

Although this curriculum was specifically written in the context of American sports medicine fellowship training, there is applicability to the international sports and exercise medicine community. Our structured progression can be implemented by any physician interested in using Sports US in the care of their athletes and patients. Given the differences in infrastructure and training, this curriculum may need to be altered to fit the needs of the global sports and exercise medicine community. This presents an exciting opportunity for growth of Sports US worldwide.

RECORD KEEPING AND COMPETENCY

The fellow should maintain detailed records of all Sports US educational activities in which they participate throughout fellowship. The fellow should also maintain a procedure log of all diagnostic and interventional Sports US procedures, including their role in the procedure (eg, observation, performance, interpretation, and/or reporting). Detailed record keeping serves these multiple purposes: (1) assists with credentialing, (2) assists in practice accreditation, and (3) supports application for certification examinations.

Although maintaining records of the type and number of diagnostic and interventional ultrasound procedures is important, performing a specific number of ultrasound procedures does not necessarily determine competence. A milestone system has been accepted by the Accreditation Council for Graduate Medical Education as a more appropriate way of determining competence. The progression of this curriculum was designed to follow the milestone system, and sample milestones are provided in the online Supplemental Digital Content 2 (see Appendix 2, http://links.lww.com/JSM/A271). Although these milestones provide structure and targets for fellows, they should not be considered requirements for graduation. Determination of readiness for graduation remains with the fellowship program director. Furthermore, given the natural variance in patient population and presentation of certain conditions, it is not expected that all fellows must document every listed pathology and procedure within a certain milestone to demonstrate competence.

Finally, it is recommended that each fellowship program develop an objective written and/or practical test to assist in assessing the sports medicine fellow’s Sports US knowledge and skill. A sample objective structured clinical examination (OSCE) is provided in the online Supplemental Digital Content 3 (see Appendix 3, http://links.lww.com/JSM/A272).

References