

Musculoskeletal and Sports Medicine PM&R Curriculum Guidelines

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INTRODUCTION

I. OVERVIEW OF THE PROJECT

The Musculoskeletal and Sports Medicine PM&R Curriculum Guidelines were developed to assist residents and residency program directors in defining a recommended training strategy for PM&R in the realm of Musculoskeletal & Sports Medicine. As is the case for all areas of Physiatric training, the knowledge and skills in the areas of Musculoskeletal and Sports Medicine should be attained through longitudinal experience that promotes educational competencies defined by the Accreditation Council for Graduate Medical Education (<http://www.acgme.org>). The curriculum should include structured experience in several specified areas unique to the Physiatrist that will be gained by caring for ambulatory patients in the clinic setting as well as structured didactic lectures, conferences, journal clubs and workshops with an emphasis on outcomes-oriented, evidence-based studies.

II. GOALS OF THE TASK FORCE

These Curriculum Guidelines were developed as a consensus opinion from the American Medical Society of Sports Medicine Education Subcommittee task force members comprised of Physiatrists with specialization in the field of Sports Medicine. The goal of the Guidelines was to assist residents and residency programs in defining their own learning objectives, with the understanding that many residencies may provide limited sports medicine training over the course of their residency and may or may not include on-field sports exposure and instruction in primary care sports issues. Each residency program is responsible for its own curriculum and should consider utilizing these guidelines, as appropriate.

III. SCOPE AND ORGANIZATION OF THE GUIDELINES

This document is organized into four major topic areas with a Physiatric focus: Musculoskeletal Medicine, Other Physiatric Areas of Sports Medicine; Basic Science Foundations of Sports Medicine; and Special Topics Within Sports Medicine. The Musculoskeletal Medicine section is organized by body region. For each body region, learning objectives should include the performance of an appropriate H&P and demonstration of familiarity with relevant, basic diagnostic imaging and treatment, but a detailed description of these goals is beyond the scope of this document. Rather, for each body region, these guidelines provide specific high-yield learning objectives related to the most important musculoskeletal conditions and physiatric interventions for that region. Electrodiagnostic medicine and musculoskeletal ultrasound are addressed in individual sections. Resources published elsewhere for the delineation of specific objectives for H&P and diagnostic imaging could include the *PASSOR MSK Physical Exam Competencies List* and various PM&R- focused textbooks.

OUTLINE:

I. MUSCULOSKELETAL MEDICINE

- A. Cervical Spine Region
- B. Shoulder Region
- C. Elbow Region
- D. Wrist/ Hand Region
- E. Thoracic Spine/ Chest Region
- F. Lumbar Spine Region
- G. Pelvis/ Hip Region
- H. Knee Region
- I. Ankle/ Foot Region

II. OTHER PHYSIATRIC AREAS OF SPORTS MEDICINE

- A. Concussion/ Brain Injury in Sports
- B. Spinal Cord Injury in Sports
- C. Cardiopulmonary Sports Medicine, including Exercise Physiology
- D. Nutrition/ Metabolism/ Endocrine Issues in Sports
- E. Women's Health, including Female Athlete Triad
- F. Pediatric Sports Medicine
- G. Electrodiagnosis in Sports
- H. Prosthetics & Orthotics in Sports
- I. The Disabled Athlete
- J. Exercise as Medicine & Integrative Sports Medicine

III. BASIC SCIENCE FOUNDATIONS OF SPORTS MEDICINE

- A. Pathophysiology of Tissues/ Organs
- B. Fundamental Biomechanical Principles
- C. Imaging Fundamentals for Sports Medicine
- D. Laboratory Studies in Sports Medicine
- E. Medications Commonly Used in Sports Medicine

IV. SPECIAL TOPICS WITHIN SPORTS MEDICINE

- A. Prevention & Screening, including PPE
- B. Sideline Coverage & Sports Medicine Emergencies
- C. Primary Care Sports Issues
- D. Sports Dermatology
- E. Musculoskeletal Ultrasound
- F. Communication & Teamwork in Sports Medicine
- G. Ethical & Medico-Legal Aspects and Professionalism in Sports Medicine

GUIDELINES:

I. MUSCULOSKELETAL MEDICINE

A. CERVICAL SPINE REGION

1. **H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, and MRI) of the cervical spine.
2. **Cervical Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
 - a. **Cervical Strain and Sprain.** Identify the origins, insertions, actions, and innervations of the cervical muscles. Identify the ligaments of the cervical spine and how each contributes to the static stability of the cervical spine. Describe the role of imaging with flexion-extension radiographs. Describe the role of cervical orthoses in the acute management of cervical strains. Describe a rehabilitation program including postural reeducation, functional restoration, and neck stretching and strengthening to exercises for athletes who sustain a neck strain or sprain without any instability.
 - b. **Ligamentous Injury/ Instability.** Describe the radiologic criteria for instability on flexion/ extension radiographs. Describe the specific consideration for patients with Down's Syndrome, including the role of screening radiographs and restriction from specific sports. Describe Klippel-Feil syndrome and the role of imaging and considerations for sports participation for these patients.
 - c. **Cervical Spinal Stenosis.** Describe the clinical presentation of patients with spinal stenosis. Describe how to calculate the Torg/Pavlov ratio, and the uses and limitations of this measurement.
 - d. **Cervical Fractures.** Describe the anatomy of the cervical spine. Describe mechanism and management of each of these specific fractures to the cervical spine: Jefferson fracture, posterior arch fracture of C1, Hangman's fracture, Odontoid fractures (types I-III), Vertebral body compression fractures (type I-V). Describe the phases of fracture healing.
 - e. **Transient Quadriplegia/Cervical Cord Neuropraxia.** Describe the typical clinical presentation, mechanism, incidence, and recurrence rate of transient quadriplegia. Describe the considerations related to return to play for patients with a single episode compared to repeated episodes of transient quadriplegia.
 - f. **Cervical Radiculitis/Radiculopathy.** Describe the neuroanatomy of the cervical spine, spinal nerve roots, and brachial plexus. Describe the typical presentation based on root level involvement. Describe the expected electrodiagnostic findings of a cervical radiculopathy at 1 week, 3-4 weeks, 5-6 weeks, and greater than 6 months. Contrast the electrodiagnostic findings of cervical radiculopathy with those observed with a nerve root avulsion or burner/stinger. Describe the indications for a cervical epidural steroid injection and for surgical interventions.
 - g. **Burners/ Stingers.** Describe the typical mechanism of transient neuropraxia of the brachial plexus (burners/stingers). Describe the estimated incidence of this

injury among football players and which nerve roots are most often affected. Describe the role for, including the appropriate timing of, electrodiagnostic studies for evaluation and prognosis for a burner/ stinger. Describe the typical treatment and the considerations for role of return to play.

- h. **Cervical Facet Arthropathy.** Identify the most commonly affected joints of the cervical spine and describe their typical pain referral pattern.
- i. **Cervical Spinal Cord Injury.** See separate Spinal Cord Injury section.
3. **Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
 - a. **Cervical Zygapophyseal (Facet) Joint Injections.**
 - b. **Cervical Epidural Injections.**
 - c. **Cervical Region Trigger Point and other Intramuscular Injections.**

B. SHOULDER REGION

1. **H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, US, and MRI) of the shoulder.
2. **Shoulder Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
 - a. **Scapular Dyskinesia and Scapular Winging.** Identify the scapular stabilization muscles and describe their role in optimizing scapulothoracic function. Discuss the relevance of evaluating kinetic chain mechanics and sport specific technique in an athlete with shoulder pain. Describe the presentations and causes of lateral vs. medial scapular winging.
 - b. **Acromioclavicular (AC) Joint Sprains/ Tears.** Describe the structure of the AC joint and the classification of AC injury (I-VI). Review which classes of AC joint sprains require a surgical consultation.
 - c. **Shoulder Instability and Dislocation.** Describe the typical causes and presentations of anterior vs. posterior shoulder dislocations. Discuss potential associated conditions, including Bankart and Hill-Sachs lesions and neurovascular injury. Describe a clinical approach to the hypermobile athlete. Understand the risk of recurrence for first time shoulder dislocations in the young athlete.
 - d. **Rotator Cuff Tendinopathy, Rotator Cuff Tears, and Shoulder Impingement Syndrome.** Identify the rotator cuff muscles and discuss their function. Describe the mechanism of and contributing factors to impingement. Describe the natural history of rotator cuff tears and indications/ contraindications for surgical repair. Discuss the importance of evaluating the neck in patients with shoulder problems.
 - e. **Bicipital Tenosynovitis, Tendinopathy and Proximal Biceps Tendon Rupture.** Not indications for and types of injection to manage injuries.
 - f. **Labral Pathology, including SLAP Lesion.** Describe the structure and function of the glenoid labrum.
 - g. **Adhesive Capsulitis.** Describe what distinguishes adhesive capsulitis from other shoulder problems, its mechanism, and its natural history. Note phases of treatment.
 - h. **Parsonage-Turner Syndrome and other Brachial Plexopathies.** Delineate the brachial plexus.

- i. **Suprascapular Neuropathy.**
- j. **Thoracic Outlet Syndrome.** See separate Thoracic Spine/ Chest Region section.
- k. **Glenohumeral (GH) Arthritis.**
- l. **Fractures of the Shoulder Region.**
 - i. **Clavicular Fracture.** Explain where clavicle fractures most commonly occur and the amount of shortening and displacement acceptable to treat non-operatively.
 - ii. **Scapular Fracture**
 - iii. **Proximal Humerus Fracture.** Review the Neer Classification scheme.
- 3. **Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
 - a. **Subacromial Injection.**
 - b. **Bicipital Tendon Sheath Injection.**
 - c. **GH Joint Injection.**
 - d. **AC Joint Injection.**
 - e. **Suprascapular Nerve Block.**
 - f. **Shoulder Joint Reduction.**

C. ELBOW REGION

- 1. **H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, US, and MRI) of the elbow.
- 2. **Elbow Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
 - a. **Lateral Epicondylitis/osis.** Identify the most commonly involved muscle. Review the different treatment algorithms for acute epicondylitis versus chronic lateral epicondylitis. Review the most recent literature on corticosteroid injections and their short-term versus long-term efficacy.
 - b. **Medial Epicondylitis/osis.** Identify the most commonly involved muscle. Review the differences in management of acute vs. chronic medial epicondylitis.
 - c. **Olecranon Bursitis.** Discuss the differences between acute and chronic olecranon bursitis.
 - d. **Distal Biceps Tendon Rupture.** Describe the most common mechanism of this injury. Articulate why surgical repair is recommended for this injury when it is not generally recommended for proximal bicep tendon disruption.
 - e. **Triceps Tendinitis.** Discuss the most common causes and what preventive measures should be undertaken to decrease risk of recurrence.
 - f. **Ulnar Collateral Ligament (UCL) Injury of the Elbow.** Describe the biomechanical importance of the UCL in relation to overhead throwers. Review the gold standard imaging modality to diagnose this injury. Explain what preventative measures are used to decrease risk of this injury.
 - g. **Valgus Extension Overload Syndrome (VEOS)/ Posterolateral Rotatory Instability.** Know the overhand pitching cycle and review the phases and events of throwing. Describe the biomechanical importance of the UCL ligament in relation to overhead throwers. Describe the differences between VEOS and an UCL disruption.

- h. **Medial Epicondylar Apophysitis (Little League Elbow).** Discuss the importance of rest and pitch restrictions and how this impacts adolescent elbow throwing injuries. State the order of epiphyseal closure of the growth plates in the adolescent elbow, with ages.
 - i. **Anterior Interosseous Nerve (AIN) Syndrome.** Review the AIN innervated muscles. Predict the common signs and symptoms of AIN Syndrome. Prepare an electromyographic study to evaluate for AIN injury.
 - j. **Pronator Syndrome.** Discuss the potential sites of compression of the median nerve. Prepare an electromyographic study to evaluate for this syndrome.
 - k. **Posterior Interosseous Nerve (PIN, i.e Radial Tunnel) Syndrome.** Review the PIN innervated muscles. Predict the common signs and symptoms of a patient that may have PIN Syndrome. Explain why there is no sensory component associated with this syndrome.
 - l. **Cubital Tunnel Syndrome.** Describe the type of elbow fractures associated with this type of nerve injury.
 - m. **Elbow Dislocations.** Review the classification scheme of elbow dislocations. Differentiate between simple versus complex dislocations. Understand the importance of a timely neurovascular examination.
 - n. **Radial Head Subluxation (Nursemaid’s Elbow).** Describe the mechanism of injury and why the size of the radial head diameter plays a role.
 - o. **Osteochondritis Dissecans of the Elbow.** Describe the typical location of OCD of the elbow. Differentiate the treatment algorithm in displaced versus non-displaced lesions. Describe the difference between OCD of the elbow and Panner’s Disease (see Pediatric Sports Medicine section).
 - p. **Volar Compartment Syndrome (Volkmann’s Ischemia).** Review the fractures that are associated with this syndrome. Discuss the most common of the 6 “P’s” associated with this injury. Explain why this type of injury is a potential surgical emergency.
 - q. **Fractures of the Elbow Region.**
 - i. **Distal Humerus.**
 - ii. **Radius.**
 - iii. **Ulna.**
3. **Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
- a. **Elbow Joint Injection and/or Aspiration.**
 - b. **Olecranon Bursa Aspiration and/or Injection.**
 - c. **Lateral Epicondylitis/osis Injection.**
 - d. **Medial Epicondylitis/osis Injection.**
 - e. **Radial Head Subluxation.**
 - f. **Posterior Elbow Dislocation Reduction.**

D. WRIST/ HAND REGION

- 1. **H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, US, and MRI) of the wrist/hand.

- 2. Wrist and Hand Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
- a. **Tendon/Cartilage Injury.**
 - i. **DeQuervain's Tenosynovitis.** Identify the involved tendons. Review the contents of each dorsal wrist compartment.
 - ii. **Intersection Syndrome.** Identify the involved tendons. Explain the difference, clinically, between this syndrome and DeQuervain's Tenosynovitis.
 - iii. **Mallet Finger and Jersey Finger.** Describe the mechanisms of injury. Describe what is seen on clinical examination in each case. Explain the treatment algorithm and justify non-surgical management versus surgical management for each.
 - iv. **Trigger Finger.** Describe the natural history of this syndrome and the cause of the mechanical catching. Discuss treatment options, including collagenase injections.
 - v. **Boutonniere Deformity.** Describe the mechanism of injury, what structure is injured, and the treatment algorithm in acute and chronic (i.e. > 6 weeks) cases.
 - vi. **TFCC Injury.** Describe the clinical importance of positive versus negative ulnar variance and how it relates to the Triangular Fibrocartilage Complex (TFCC). Describe the many potential mechanisms of injury. Review the gold standard imaging modality. Explain when surgical consultation is indicated.
 - b. **Ligamentous Injury.**
 - i. **1st MCP Ulnar Collateral Ligament (Skier's or Gamekeeper's Thumb).** Review the mechanism of injury and explain why it is important to image the injury prior to stressing the thumb. Define a Stener lesion and how the presence of one can change treatment decisions. Describe treatment options and their time frames.
 - c. **Fractures of the Wrist/ Hand Region.**
 - i. **Distal Radius/Ulnar.** Describe the most common mechanism of injury. Explain when to use a short arm cast versus a long arm cast. Review the indications for surgical versus non-operative management.
 - ii. **Scaphoid.** Describe the appropriate radiologic views to evaluate for this injury and discuss the role of x-rays in diagnosing scaphoid fracture. Describe the anatomy of the scaphoid and its blood supply and how location of fracture could affect healing and management decisions.
 - iii. **Metacarpal.** Describe how to look for shortening on examination. Review the amount of angulation required to perform a reduction per digit. State the amount of shortening in oblique and spiral fractures that require surgical fixation. Explain the differences between a Bennett fracture and Rolando fracture.
 - d. **Common Dislocations.**
 - i. **DRUJ.** Describe the most common mechanism of injury. Explain when non-operative treatment is acceptable.

- ii. **IP.** Explain why dorsal dislocation is more common than volar for PIP dislocations. Why are athletes in contact sports most at risk? Describe the most common mechanism of injury for DIP dislocations. Explain the association of a DIP dislocation with a Mallet Finger.
- e. **Miscellaneous Injury.**
 - i. **Ganglion Cysts.** Describe the most common location to find this cyst. Describe the treatment algorithms for conservative and operative management. Review the imaging modalities to confirm diagnosis.
 - ii. **Subungual Hematoma.** Explain why a radiograph should be ordered with any acute hematoma of the nail bed. Describe the procedure of how to drain this type of a hematoma.
- 3. **Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
 - a. **Carpal Tunnel Injection.**
 - b. **De Quervain's Tenosynovitis Injection.**
 - c. **Carpometacarpal Joint Injection.**
 - d. **Trigger Finger Injections.**
 - e. **Ganglion Cyst Aspiration.**
 - f. **Posterior Elbow Dislocation/ Reduction.**

E. THORACIC SPINE/ CHEST REGION

- 1. **H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, and MRI) of the thorax.
- 2. **Thoracic Spine/ Chest Musculoskeletal Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
 - a. **Thoracic Spinal Disorders.**
 - i. **Thoracic Degenerative Disc Disease, including HNP.** Describe why HNPs occur less frequently in the thoracic spine than in the lumbar or cervical spine.
 - ii. **Thoracic Vertebral Compression Fracture.** Articulate a biomechanical theory of spinal support as well as a categorization system of spinal fractures. Describe the risks and benefits of conservative management vs. interventional treatment.
 - iii. **Kyphosis.** Describe the specific diagnostic criteria of Scheuermann's Disease.
 - iv. **Thoracic Zygapophyseal Arthropathy.** Describe the typical pain patterns for these joints and the evidence for their role as pain generators.
 - v. **Ankylosing Spondylitis.** Describe an appropriate workup for the spondyloarthropathies.
 - b. **Costal Disorders.**
 - i. **Rib fractures.** Describe the differential presentation of rib stress fractures vs. acute fracture, and complete vs. incomplete injuries. Describe the mechanism of injury and presentation for Flail Chest. Know the treatment and prognosis for return to activity.

- ii. **Costovertebral and costotransverse disorders.** Describe costochondritis, costochondral sprain and separation.
- c. **Sternal Disorders.**
 - i. **Sternoclavicular sprains, subluxations, and dislocations.** Describe the differences between first vs. second degree sprains and Type I, II, and III subluxations/ dislocations, as well as the relative dangers of whether the latter is anterior vs. posterior.
 - ii. **Sternal Fractures.**
- d. **Soft Tissue Disorders.**
 - i. **Pectoral Strains and Tears.** Describe a typical mechanism of injury, the different anatomical sites of injury, and the role of conservative vs. surgical treatment. Describe a presentation that would be more likely to be associated with performance-enhancing drugs.
- e. **Disorders of the Vasculature and Vital Organs.**
 - i. **Thoracic Outlet Syndrome (TOS).** Describe the various mechanisms of injury in supraclavicular, subclavicular, costoclavicular, and infraclavicular region. Identify the various presentations for each type of TOS, namely neural, arterial, and venous compression symptoms, and understand that compression can be postural/functional.
 - ii. **Aortic Aneurysm.**
 - iii. **Splenic Rupture.**
- 3. **Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
 - a. **Thoracic Zygapophyseal (Facet) Joint Injections.**
 - b. **Thoracic Epidural Injections.**
 - c. **Thoracic Region Trigger Point and other Intramuscular Injections.**

F. LUMBAR SPINE REGION

- 1. **H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, and MRI) of the lumbar spine.
- 2. **Lumbar Spine Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
 - a. **Spondylolysis.** Identify the different types, the reliability of different imaging modalities in making this diagnosis, and management options and return to play guidelines.
 - b. **Spondylolesthesis.** Describe the different clinical causes, grading of this condition, the natural history, and management options.
 - c. **Spondylosis.** Describe the normal anatomy and physiology of the spine and the degenerative cascade (dysfunction, instability and stabilization). Understand common radiographic finding and utility of advanced imaging and electrodiagnostic testing. Know the proper use of use of bracing, injections, and core strengthening techniques, and understand return to play criteria.
 - d. **Spinal Stenosis.** Describe central vs. neuroforaminal spinal stenosis, including clinical presentation and indications for surgical management.

- e. **Annular Tear.** Understand the anatomy of the annulus, including fiber alignment, blood supply, and innervation. Know the mechanism of injury and natural history.
 - f. **Herniated Nucleus Pulposus (HNP).** Describe the myriad pain patterns that can be elicited from an HNP. Describe the prevalence of asymptomatic HNP in the general population as a function of age.
 - g. **Lumbosacral Radiculitis/ Radiculopathy.** Describe the typical dermatomal pain patterns and myotomal weakness and/or reflex changes at the levels of the lumbosacral spine.
 - h. **Mechanical Causes of Lumbar Pain.** Understand anatomy and presentation of mechanical low back pain and importance of “core strength” and lower extremity flexibility. Understand how errors in training, technique, and improper equipment can predispose to injury.
 - i. **Medical Causes of Lumbar pain.** Understand and describe medical illness’ that can cause lumbar pain including rheumatologic renal, pancreatic, hepatic, vascular, pulmonary, hematologic including splenic, malignant and non-malignant etiologies, and infectious causes including discitis, osteomyelitis, STDs, tuberculosis, etc.
 - j. **Pediatric/Youth Injuries.** Know the typical injuries associated with the skeletally immature, including spondylolysis, scoliosis; congenital anomalies not previously documented; tumors of childhood, JRA.
 - k. **Lumbar Vertebral Fracture.**
3. **Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
- a. **Lumbar Zygapophyseal (facet) Joint Injection.**
 - b. **Lumbar Medial Branch Block and Radiofrequency Ablation.**
 - c. **Lumbar Epidural Injections, including Transforaminal, Interlaminar, and Caudal Approaches.**
 - d. **Lumbar Region Trigger Point and other Intramuscular Injections.**
 - e. **Sacroiliac joint injection.**
 - f. **Lumbar Discography.**

G. PELVIS/ HIP REGION

1. **H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, US, and MRI) of the pelvis/ hip.
2. **Pelvis/ Hip Musculoskeletal Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
 - i. **Femoroacetabular Impingement.** Describe the two types of FAI (CAM, Pincer) and how these deformities lead to abnormal contact between the femur and the acetabulum. Understand that the distribution of pain can be groin, lateral hip (“C sign”) and/or in the posterior pelvis. Discuss the association of FAI with labral pathology. Understand the role of the diagnostic hip injection.
 - ii. **Hip Labral Tear.** Recognize the prevalence of asymptomatic labral tears. Understand the relationship between labral tears and the development of early

- osteoarthritis. Discuss appropriate imaging modalities for labral tears (MRA vs. 3T MRI vs. US).
- iii. **Osteoarthritis.** Discuss the risk factors for hip osteoarthritis. Describe the role of aerobic exercises and strength training in management of hip osteoarthritis.
 - iv. **Avascular Necrosis.** Discuss risk factors and role of imaging in diagnosis.
 - v. **Slipped Capital Femoral Epiphysis (SCFE) and Perthes Disease** (see Pediatrics)
- b. **Extra-Articular Hip Disorders:**
- i. **Femoral Neck Stress Fracture.** Discuss the risk factors for femoral neck stress fractures. Describe the two types: compression-side vs. tension-side and the implications for management.
 - ii. **Greater Trochanteric Pain Syndrome (GTPS).** Describe the diagnostic criteria for GTPS. Understand the importance of ruling out referred pain from the lumbar spine and the hip joint in patients with this presentation. Discuss the role of hip abductor weakness in GTPS.
 - iii. **Snapping Hip.** Describe the structures involved in the three types of snapping hip: external, internal and intra-articular.
 - iv. **Piriformis Syndrome.** Describe the pathophysiology of piriformis syndrome. Discuss how to differentiate between piriformis syndrome vs. L5-S1 radiculopathy.
- c. **Pelvic Disorders:**
- i. **Hip Pointer.** Discuss the muscles that insert onto the iliac crest. Describe physical examination or radiographic findings to help rule out an avulsion.
 - ii. **Athletic Pubalgia.** Described the primary sites of pathology. Discuss the proposed mechanism of injury.
 - iii. **Osteitis Pubis.** Describe the proposed underlying mechanism and radiographic finding associated with osteitis pubis.
 - iv. **Adductor Strain.** Discuss the grading scale for muscle strains. Describe the most common mechanism of injury.
 - v. **Stress Fractures.** Describe the risk factors associated with pubic ramus and sacral stress fractures. Discuss the utility of xray vs. MRI vs. bone scan to diagnose pelvic stress fractures
 - vi. **Sacroiliac Joint Dysfunction/Pain.** Discuss the risk factors for SIJ pain. Describe the utility of combining 4-5 physical exam provocative maneuvers to diagnose SIJ pain.
 - vii. **Pelvic Floor Dysfunction/Pain.** Define the muscles that comprise the pelvic floor. Understand the manifestations of pelvic floor dysfunction in athletes, including stress urinary incontinence and pain.
3. **Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
- a. **Intra-articular Hip Injection.**
 - b. **Sacroiliac Joint injection.**
 - c. **Greater Trochanteric Bursa Injection.**
 - d. **Iliopsoas Bursa Injection.**
 - e. **Pubic Symphysis Injection.**

H. KNEE REGION

1. **H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, US, and MRI) of the knee.
2. **Knee Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
 - a. **Patellofemoral pain syndrome (PFPS).** Identify the underlying factors contributing to patellar tracking/maltracking.
 - b. **Iliotibial Band Syndrome (ITBS).** Describe some of the muscular imbalances and dysfunctions that may contribute to this syndrome. Describe the anatomy of the IT band.
 - c. **Plica Syndrome/Medial Plica Syndrome.** Identify the features that help distinguish medial plica syndrome from PFPS or injuries to the medial meniscus.
 - d. **Patellar tendinopathy and patellar tendon rupture.** Describe the role of ultrasound in aiding in diagnosis of patellar tendinopathy.
 - e. **Quadriceps tendinopathy and quadriceps tendon rupture.**
 - f. **Patellar subluxation/dislocation.** Describe the common factors underlying PFPS and patellar dislocation. Describe some of the pathoanatomic variants that may contribute to recurrent episodes and failure of even surgical management if not adequately addressed.
 - g. **Pre-patellar/Infra-patellar/supra-patellar bursitis.** Review the typical causes of each type of bursitis. Also identify typical associated conditions.
 - h. **Pes anserine bursitis/tendinitis.** Describe the location and anatomic structures comprising the pes anserinus.
 - i. **Baker's cyst/ popliteal cyst.** Describe the association between popliteal cysts and intra-articular pathologies such as OA. Describe the typical location and anatomy of a Baker's cyst, including the surrounding musculature.
 - j. **Osteoarthritis (OA).** Explain why weight-bearing films are preferred to non-weight bearing X-Rays when evaluating Knee OA. Define what a "sunrise" view is, and why it is obtained. Explain the role of visco-supplementation in the conservative management of knee osteoarthritis.
 - k. **Meniscus Tears.** Differentiate the typical features of traumatic vs. degenerative meniscus tears. Describe at least three provocative physical exam maneuvers for testing of meniscal injury. Describe the "double PCL" sign. Explain why bucket handle tears require surgical referral and with what urgency. Explain what areas of the meniscus receive greater vascularity and its application to the management of meniscal injuries.
 - l. **Medial and Lateral Collateral Ligament Tears.**
 - m. **Anterior Cruciate Ligament Tear.** Be familiar with the role of biomechanical prevention programs in preventing ACL injuries.

- n. **Posterior Cruciate Ligament Tear.** Describe the role of non-operative management for PCL tears.
 - o. **Posterolateral corner injury.** Know the relevant anatomy of the PLC. Identify the three most important static stabilizers of the posterolateral knee, and what movements they restrict. Identify the two other important ligamentous structures commonly injured along with the PLC.
 - p. **Tibial plateau fracture.** Describe the associated neurovascular risks associated with medial tibial plateau fractures.
 - q. **Osteochondritis dessicans.** Describe the most common location for an OCD lesion in the knee.
 - r. **Sinding-Larsen-Johansson Disease and Osgood-Schlatter's Disease.** Describe the typical patient population in which these conditions appear.
 - s. **Fractures.** Describe the common fractures about the knee.
- 3. Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
- a. **Intra-articular knee joint injection**
 - b. **Knee joint effusion aspiration**
 - c. **Pre-patellar bursa aspiration and injection**
 - d. **Baker's cyst aspiration**
 - e. **Patellar reduction**

I. ANKLE/ FOOT REGION

- 1. H&P and Imaging.** Perform an appropriate H&P and demonstrate familiarity with the fundamentals of diagnostic imaging (X-Ray, CT, US, and MRI) of the ankle/ foot.
- 2. Ankle/ Foot Conditions.** For each condition describe typical clinical presentation, diagnostic criteria, and non-surgical and surgical management, including rehabilitation prescription, as appropriate. Additional objectives are below.
 - a. Ankle**
 - i. **Lateral ankle sprain.** Identify the lateral ankle stabilizing ligaments and classification of injury. Discuss potential associated conditions such as anterior process calcaneus fracture, peroneal tendinopathy, sinus tarsi syndrome, intraarticular pathology.
 - ii. **High ankle sprain.** syndesmotic injury. Discuss mechanism of injury. Describe radiographic findings in unstable sprain.
 - iii. **Peroneal tendinopathy.** Describe anatomy and function of peroneus longus, brevis, superficial peroneal retinaculum. Describe exam maneuver for snapping peroneal.
 - iv. **Sinus tarsi syndrome.** Describe anatomic confines of sinus tarsi.
 - v. **Anterior ankle impingement.** Discuss bony versus soft tissue impingement and risk factors.
 - vi. **Posterior tibial tendinopathy.** Discuss the classification of posterior tibial dysfunction and acquired flat foot deformity. Discuss orthotic / bracing options.
 - vii. **Achilles tendinopathy/ retrocalcaneal bursitis.** Differentiate anatomy and pathophysiology of Achilles peritenonitis, midsubstance tendinosis, insertional tendinopathy and retrocalcaneal bursitis / subcutaneous bursitis.

- viii. **Posterior ankle impingement / os trigonum syndrome/ flexor hallucis longus tendinopathy.**
 - ix. **Talar osteochondral injury.**
 - x. **Tarsal tunnel syndrome.** Describe anatomy of the tarsal tunnel. Describe the innervation to the foot and ankle region, including the Saphenous nerve, Superficial and Deep peroneal nerves, Sural nerve, Medial and Lateral Plantar nerves.
- b. Foot**
- i. Hindfoot.**
 - **Plantar fasciopathy.** Describe the Windlass mechanism, the basic biomechanics of gait, and the purpose of an orthotic device for the foot.
 - **Calcaneal stress fracture.**
 - **Talocalcaneal coalition.**
 - ii. Midfoot.**
 - **Navicular stress fracture / os navicularis.**
 - **Lisfranc injury.** Describe anatomy of ligament complex. Mechanism of injury. Most frequently misdiagnosed injury of foot. Appropriate radiographic workup and determining stability of injury. Appropriate triage to orthopaedics.
 - iii. Forefoot.**
 - **Metatarsal injury.** For the 5th metatarsal fracture, describe 3 zones of injury, an Avulsion fracture, a Jones fracture, and a Dancer's fracture, including classification of injury and triage to orthopaedic surgery.
 - **Morton's neuroma.**
 - **Friberg's Infracrion.**
 - **Turf toe / 1st MTP plantar plate sprain.** Describe anatomy of region
 - **Hallux rigidus.**
 - **Crystall-induced arthropathy.**
 - **Gout / Pseudogout.**
 - **Sesamoid injury.** Discuss sesamoiditis, sesamoid stress injury, bipartite sesamoid.
 - **Hammer toe / claw toe.**
 - **Hallux valgus deformity/ bunion.**
 - **Metatarsalgia.**
 - **MTP synovitis.**
- 3. Interventions.** For each physiatric intervention, describe the approach, imaging modality (as appropriate), indications, and precautions.
- a. Fracture Management of the foot.**
 - i. Know the fundamentals of acute splinting and casting.
 - ii. Understand appropriate criteria for triage to orthopedic service.
 - b. Common ultrasound-guided Injections**
 - i. Tibiotalar.**
 - ii. Subtalar.**
 - iii. Peroneal Tendon Sheath.**
 - iv. Sinus Tarsi.**

- v. **Achilles Peritenon / Brisement procedure.**
 - vi. **Retrocalcaneal Bursa.**
 - vii. **Plantar fascia.**
 - viii. **Flexor Hallucis Longus Tendon Sheath.**
 - ix. **Os Trigonum / Posterior Ankle Impingement.**
 - x. **Tarsometatarsal Joint.**
 - xi. **1st MTP Joint.**
 - xii. **Morton's Neuroma.**
- c. **Compartment Pressure Testing of lower limb**

II. OTHER PHYSIATRIC AREAS OF SPORTS MEDICINE

A. CONCUSSION/ BRAIN INJURY IN SPORTS

1. **Define concussion.** Describe the mechanism of injury and pathophysiology of mild traumatic brain injury (primary and secondary injury). Describe the signs and symptoms.
2. **Identify risk factors** for injury and their role for a protracted course, including age; gender; genetics; sport; position; medical and psychiatric history, and history and nature of the injury (number of injuries, severity, and duration of symptoms).
3. **Describe an appropriate evaluation** of a concussion, including:
 - a. Pre-injury testing: baseline testing / pre-participation exam.
 - b. Sideline Evaluation and Management.
 - i. Rule out of catastrophic head / neck injury.
 - ii. Role of sideline assessment tools.
 - iii. Rules regarding prohibition of same day return to play if concussion is suspected.
 - c. Comprehensive Clinic Evaluation including:
 - i. Symptom inventory: Physical, Cognitive, Sleep, Emotional.
 - ii. Neurological examination.
 - iii. Balance assessment.
 - iv. Mental status evaluation.
 - d. Role of Neuropsychological Testing.
 - e. Role of Neuroimaging.
4. **Know the fundamentals of clinical management** of a concussion including:
 - a. Relative physical and cognitive rest.
 - b. Role of medication management.
 - c. Vestibular therapy.
 - d. Return to academics.
 - e. Return to athletics through a graded exertional program.
5. **Describe Post-concussion Syndrome**, including the role of a multi-disciplinary approach, medications, and an exercise prescription.
6. **Be familiar with these fundamental concepts:**
 - a. Second impact syndrome.
 - b. Disqualification from sport.
 - c. Chronic traumatic encephalopathy.

7. **Describe local and national efforts** for prevention, education, and legislation regarding concussion in sports.
8. **Discuss various prevention strategies for concussion in sports**, such as rule changes, tackling technique, and equipment modification.

B. SPINAL CORD INJURY IN SPORTS

1. **Define spinal cord injury. Compare and contrast the mechanism of injury, neurologic deficits, and prognosis of the following acute spinal cord injuries:**
 - a. Complete Spinal Cord Injury.
 - b. Anterior Cord Syndrome.
 - c. Central Cord Syndrome.
 - d. Brown-Séguard Syndrome.
 - e. Cervical cord neurapraxia (transient quadriplegia or transient neurapraxia).
Include the incidence and recurrence rate of transient quadriplegia. Describe the considerations related to return to play for patients with a single episode compared to repeated episodes of transient quadriplegia.
2. **Describe the on-field examination and management** of suspected cervical spine injuries, including:
 - a. Describe the physical examination of an athlete with a suspected cervical spine injury and list signs and symptoms concerning for a spinal cord injury that necessitate immobilization.
 - b. List the sideline equipment that may be necessary for management of an athlete with a spinal cord injury.
 - c. List the step-by-step procedure for spine boarding an athlete on the field. Contrast how this procedure differs for athletes wearing full football pads and helmet versus an athlete wearing football helmet without pads, versus an athlete who is not wearing equipment. Review the procedure for removing facemasks.
 - d. Describe how to evaluate an ambulatory athlete on the sideline for a suspected cervical spine injury. In an athlete with transient neurologic symptoms, what criteria should be met before considering return to play.
3. **Describe the role of imaging** for cervical injuries, including:
 - a. **AP and lateral, open-mouth odontoid radiographs.**
 - b. **Flexion and extension radiographs.** Describe how cervical spasms may limit the sensitivity this test. Describe the radiologic criteria for instability on flexion/extension radiographs.
 - c. **MRI.**
 - d. **CT.**
 - e. **SCIWORA.** Define and describe its significance.
4. **Describe how to perform an ASIA examination** and how it relates to motor recovery prognosis. Identify the upper extremity muscles innervated by each cervical nerve root level.
5. **Describe the presentation and management of autonomic dysreflexia (AD)**, including which spinal cord injury levels are susceptible to AD. Describe how boosting is used by SCI athletes in competitive sports and how this is monitored/detected during competition.

C. CARDIOPULMONARY SPORTS MEDICINE, INCLUDING EXERCISE PHYSIOLOGY

- 1. Be comfortable performing a basic cardiopulmonary H&P, including an auscultatory cardiac exam.**
- 2. Be familiar with the fundamentals of reading an EKG, and identify electrophysiologic changes of the athletic heart.**
- 3. Familiarize yourself with the standard Pre-participation Exam (PPE). See separate PPE section of these guidelines.**
- 4. Know the physiologic effects of exercise on the cardiopulmonary system.**
 - a. Understand the relationship between cardiac output, heart rate, and stroke volume.
 - b. Be familiar with the Fick Equation.
 - c. Understand the differences in the acute cardiovascular and pulmonary effects of and cardiovascular adaption to static vs. dynamic exercise.
 - d. Know the definition of VO_{2max} and how it changes with training.
 - e. Understand what adaptation is primarily responsible for increased cardiac output as a result of training.
 - f. Understand what pulmonary adaptations occur in trained individuals, including changes in respiratory rate at rest vs. submaximal and maximal exercise, tidal volume, minute ventilation, and respiratory muscle strength.
 - g. Be familiar with morphologic changes in the heart associated with static and dynamic exercise. Review the law of Laplace.
 - h. Demonstrate a familiarity with Athletic Heart Syndrome. Know the typical normal value range for left ventricular cavity size and septal thickness.
 - i. Be aware of changes in the cardiovascular system that occur following periods of deconditioning.
 - j. Be aware of approximate metabolic equivalents of task (MET) of common activities, and be aware of appropriate MET recommendations when prescribing exercise to individuals of varying fitness levels.
 - k. Be familiar with the role of perceived exertion/ the Borg Rating of Perceived Exertion (RPE) Scale in exercise prescription.
- 5. Congenital Heart Disease and Exercise**
 - a. Recognize the importance of obtaining a value for pulmonary artery pressure in directing exercise prescriptions in individuals with congenital heart disease (CHD).
 - b. Have an understanding of basic CHD terminology (e.g., cyanotic vs. acyanotic, shunt, tetralogy of Fallot, transposition, etc.).
 - c. Be familiar with the concept of static vs. dynamic exercise, and that different CHD conditions may permit high amounts of one vs. the other.
 - d. Be aware of how certain types of CHD can be at increased risk for cardiac events in collision sports (e.g., Marfan's Syndrome).
 - e. Know the historical and physical exam findings typically present in shunt lesions (e.g., ventricular septal defects, atrial septal defects, and patent ductus arteriosus).
 - f. Know the history and physical exam findings characteristic of hypertrophic cardiomyopathy (HCM).
- 6. Sudden Cardiac Death**

- a. Know what sports and age ranges have the highest incidences of sudden cardiac death (SCD), and what etiologies of SCD are more common at what age ranges.
 - b. Be aware of how non-obstructive HCM presents and how exercise can worsen the symptoms of HCM.
 - c. Be familiar with coronary anomalies associated with sudden death, including the most common anomaly.
 - d. Identify the most frequently identifiable pathogen associated with myocarditis
 - e. Know the significance of arrhythmogenic right ventricular dysplasia.
 - f. Be familiar with Long QT syndrome.
 - g. Be familiar with commotio cordis.
 - h. Know the appropriate management by a Sports Medicine Physician of commonly detected arrhythmias and syncope.
- 7. Pulmonary disorders and exercise**
- a. Be familiar with exercise induced asthma (EIA), its presentation, common triggers (including association with temperatures and humidity), and treatment.
 - b. Know the role of chronic asthma treatment in managing EIA.
 - c. Know the likelihood of exercises with high minute ventilation vs. those with low minute ventilation to exacerbate EIA.
 - d. Be able to recognize the presentation and treatment of vocal cord dysfunction (VCD).
 - e. Understand the physiologic responses to exercise that occur in individuals with COPD.

D. NUTRITION/ METABOLISM IN SPORTS

1. Energy Metabolism

- a. Describe the concept of energy balance including total energy expenditure, resting energy expenditure, physical activity, and thermal effect of food.
- b. List the components that derive the universal source of metabolic fuel in the body (ATP) and the three energy systems used in muscular activity.
- c. Describe the effects of aging on energy expenditure (resting metabolic rate and thermic effect of foods).
- d. Describe the typical order of fuel consumption and its impact on athletic performance.

2. Nutritional needs for athletes

- a. For each condition describe the nutritional requirements of carbohydrates, protein, fat, and micronutrient intake:
 - i. General training.
 - ii. Endurance athletes.
 - iii. Ultra-endurance athletes.

3. Hydration and fluid replacement

- a. Define dehydration and the potential causes of dehydration. Identify the effects on effort, performance, and balance control.
- b. Identify the best way to evaluate a hydration program.
- c. Describe the amount of fluid intake recommended before, during, and after exercise.
- d. Identify the fluid recommendations if exercise lasts more than 1 hour.

- e. Explain the effects of aging, medications and medical conditions, such as diabetes mellitus, on hydration status.
 - f. Identify the effects of hydration on heat illness and the expected levels of dysfunction associated with declining hydration.
- 4. Nutrient timing**
- a. Identify the three phases of nutrient timing, and the recommended ingestion of nutrients during each phase.
 - b. Describe the recommended doses and examples of carbohydrates and protein snacks to enhance recovery from vigorous or endurance and resistance exercises.
- 5. Selected Nutritional Issues**
- a. Identify the optimal time and ideal glycemic index for a pre-exercise meal
 - b. Define carbohydrate loading and identify differences in performance with carb loading vs. high fat/low carb diet.
 - c. Recognize the different forms of eating disorders and their impact on athletic performance, bone mineralization, and menstruation (see also Female Athlete Triad, below).
 - d. Discuss the impact of low calorie meal consumption on weight loss and the impact of starvation mode on desired weight loss.
 - e. Diabetes:
 - i. Discuss the impact of nutrition and exercise on diabetes mellitus, including risk of increased weight, hypoglycemia and hyperglycemia. Describe how the effects of nutrition impact type I diabetes vs. type 2 diabetes.
 - ii. Discuss the effects of overeating associated with insulin receptor upregulation.
 - iii. Discuss the effects of the glycemic index of foods on the diabetic athlete.
 - f. Fractures:
 - i. Discuss the nutritional risk factors that inhibit bone healing.
 - ii. Understand the role of nutrition in fracture management and recommended doses of calcium and vitamin D to promote bone healing.
 - iii. Differentiate the recommended doses of calcium for women based on their age/ menopausal state.
 - g. Distinguish between Non-Functional Overreaching (NFOR) and Overtraining syndrome (OTS).
 - i. Identify the clinical and hormonal signs and symptoms of each disorder.
 - ii. Identify possible markers for the detection of OTS.
 - h. Discuss the impact of eating disorders on sport performance and effect on body systems.
- 6. Nutritional supplementation**
- a. Identify the dose of creatine to maximize muscle mass and enhance energy and discuss the length of a typical washout period. Discuss the positive and negative effects of creating as it relates to athlete performance and weight gain.
 - b. Recognize the role and daily dose of caffeine in performance enhancement and potential side effects.
 - c. Know the uses and components of a sport drink vs an energy drink. Discuss the positive and negative aspects of these drinks as they relate to hydration, glucose, and sodium balance and carbohydrate, protein and fat metabolism.

- d. Explain the risks associated with the use of nutritional supplements as they relate to drug testing in sport.

E. WOMEN'S HEALTH, INCLUDING FEMALE ATHLETE TRIAD

1. Differences between male and female athletes

- a. Describe the major differences in skeletal growth and development, physiology and body composition, and neuromuscular movement patterns in male and female athletes. Understand which differences remain despite correction for size.
- b. Describe how these differences may affect training and performance.
- c. Compare the prevalence and mechanisms of injury in female vs. male athletes, including knee injuries (ACL injuries, patellofemoral pain syndrome), hip injuries (labral tears), joint hypermobility and osteoarthritis.

2. The Female Athlete Triad

- a. Understand the definition of the Female Athlete Triad and how it has evolved over the past 20 years. Describe the interrelationship between nutritional status, reproductive function and bone metabolism. Describe risk factors for the triad, including important historical questions to ask female athletes.
- b. Nutrition: Define energy availability and know how to calculate this for female athletes. Understand the nutritional spectrum from adequate energy availability to eating disorder.
- c. Menstruation: Understand the spectrum of menstrual dysfunction. Define primary and secondary amenorrhea, oligomenorrhea, luteal phase dysfunction and polycystic ovarian disease.
- d. Bone metabolism: Discuss the effect of different types of sports participation on bone accretion in the female athlete (with and without appropriate nutritional intake). Describe the difference between bone density and bone microarchitecture. Understand the utility of Dual-energy X-ray absorptiometry (DXA) and the difference between T and Z scores. Understand the pathophysiology of stress fractures in the setting of the female athlete triad.
- e. Describe the appropriate clinical work-up for the female athlete who is suspected of having the triad.
- f. Discuss the importance of interdisciplinary management in the female athlete triad. Understand the limitations of oral contraceptives in management of the female athlete triad.

3. Exercise/Activity in the Peripartum Female

- a. Discuss the maternal and fetal benefits and risks of exercise during pregnancy.
- b. Describe the relative and absolute contraindications for exercise during pregnancy.
- c. Understand the musculoskeletal changes that occur during pregnancy and postpartum phases.
- d. Understand the limitations in imaging and medication management in pregnant and nursing females.

4. Pelvic Floor Dysfunction in the Female Athlete

- a. Describe the origin, insertion and function of the muscles that comprise the pelvic floor.
- b. Understand the types of pelvic floor dysfunction that occur in athletes.
- c. Define stress urinary incontinence and associated risk factors.
- d. Describe the clinical assessment and management of pelvic floor dysfunction in the female athlete.

F. PEDIATRIC SPORTS MEDICINE

1. Fractures

- a. Define diaphysis, metaphysis, epiphyseal plate, and epiphysis. Review the Salter-Harris (SH) Classification and explain which type of SH fractures require surgical fixation. Explain the differences between buckle/ torus, greenstick, and plastic deformation fractures.
- b. Define avulsion injury. Review the most common type of apophyseal injuries in the shoulder, elbow, pelvis, knee, and foot.
- c. Explain why avulsion fractures are more common in the skeletally immature versus the skeletally mature. Review the common avulsion injuries at the anterior superior iliac spine, anterior inferior iliac spine, ischial tuberosity, and lesser trochanter.
- d. Describe the natural history of Slipped Capital Femoral Epiphysis (SCFE) and Perthes Disease, include clinical and radiographic findings as well as demographics.

2. Epiphysitis/Overuse

- a. Define Little League shoulder and elbow. Explain the association between fatigue, pain, and throwing. Review the pitching cycle and when injuries occur in each phase of the cycle.
- b. Recognize the most common traction injuries to the pelvis, knee, ankle, and foot. Describe the natural history and contributing factors to these overuse injuries.
- c. Explain the differences between spondylolisthesis and spondylolysis. Review the imaging studies used to diagnose pars interarticularis fractures. Review when to brace versus not brace with a pars fracture.

3. Osteo -chondrosis and -necrosis

- a. **Define Osteochondritis dessicans (OCD).** Review what makes a bony fragment stable versus unstable. State when to refer an OCD to a surgeon versus when to manage an OCD non-surgically. Explain the difference between OCD and Juvenile OCD (JOCD). Review the most common locations for an OCD lesion in the knee and the ankle.
- b. **Define Osteonecrosis.** Identify and name the osteonecrosis lesions of the elbow, wrist, spine, hip, knee, ankle, and foot in the skeletally immature. For each lesion, describe the natural history, common demographic association, imaging modality, and treatment of choice.

4. Prevention & Development

- a. Explain the importance of not specializing in one sport at an early age. Describe why appropriate attire, footwear, and appropriate fitting protective equipment are important to prevent injuries.
- b. Discuss “Love of Sport” and why coaches and parents must not cause undue pressure to have children perform while injured.

- c. Review the theories behind ACL injury in adolescents and the preponderance of female ACL injuries. Analyze preventative strategies including prehabilitation programs designed to correct biomechanical risk factors and neuromuscular controls.
 - d. Describe why physiological differences between younger and older adolescent athletes can predispose these individuals to different injuries. State the importance of staying active and healthy and its effect on socialization, physical development, and maturation of our younger athletes.
- 5. Thermoregulation**
- a. Review why greater surface area to body mass ration in children predisposes them to heat intolerance, including a slower acclimation rate.
 - b. Review fluid replacement guidelines before, during, and after exercise/competition for children and adolescents. Review the latest research on the importance of water, electrolyte-sports drinks, and chocolate milk as recovery drinks after competition in this age group.

G. ELECTRODIAGNOSIS IN SPORTS

1. **Nerve Injury Fundamentals.** Describe the classification scheme for type and severity of nerve injuries (neuropraxia, axonotomesis, and neurotmesis). Associate the type of injury with the potential for recovery and prognosis and the expected electrodiagnostic findings (immediately post injury, 4-6 weeks post injury, months post injury, and years post injury). Describe indications and rationale for neurosurgical referral for a nerve injury as well as surgical treatment options. Explain the appropriate time course for the performance of the nerve conduction studies and needle EMG exam for a suspect nerve injury and when repeat electrodiagnostic testing is indicated.
2. **Specific Nerve Injuries.** For each of the following nerve injuries, describe the typical clinical presentation, the affected nerve and specific location(s) of injury, the most common cause(s), and the electrodiagnostic findings specific to each injury.
 - a. **Cervical Spine:** stinger, cervical radiculopathy, thoracic outlet syndrome, long thoracic neuropathy.
 - b. **Shoulder:** axillary neuropathy, suprascapular neuropathy, brachial plexopathy including Parsonage-Turner Syndrome
 - c. **Elbow/ Arm:** cubital tunnel syndrome. posterior interosseous nerve (PIN) syndrome, and radial tunnel syndrome (RTS). anterior interosseous nerve (AIN) syndrome, and pronator syndrome.
 - d. **Hand/Wrist:** carpal tunnel syndrome, Guyon's Canal ulnar nerve entrapment (aka cyclist's palsy). Contrast electrodiagnostic findings in an ulnar neuropathy at the wrist with an entrapment at the elbow. Explain the anatomic causation between wheelchair sports and carpal tunnel syndrome (CTS) and ulnar Neuropathy at the wrist.
 - e. **Lumbosacral Spine:** lumbar radiculopathy. Sciatic neuropathy, lumbosacral plexopathy.
 - f. **Hip/Pelvis:** Pudendal nerve entrapment, with BSN. Femoral Neuropathy, Obturator Neuropathy.

- g. **Knee:** Peroneal neuropathy. Explain the importance of EMG evaluation the head of the Biceps Femoris.
 - h. **Foot/Ankle:** Tarsal Tunnel Syndrome (TTS). List the 5 categories of TTS and describe the sensory and motor deficits in TTS. Name 3 neurological syndromes that may produce foot drop.
- 3. Describe evaluation and management of the following injuries:**
- a. **Upper Extremity Compartment Syndrome (UECS).** Review the typical history, physical examination findings, and initial treatment of UECS. Describe the pathophysiology and management of the of Volkmann's Ischemic contractures.
 - b. **Lower Extremity Compartment Syndrome.**
 - i. **Acute Compartment Syndrome.** Review the typical history, physical examination findings, and initial treatment of acute compartment syndrome.
 - ii. **Chronic Exertional Compartment Syndrome.** Describe the natural history and treatment of Chronic Exertional Compartment Syndrome (CECS). Describe the compartments of the lower leg, including the blood supply, muscles and innervation within each compartment. Explain which athletes are most commonly affected by CECS.
 - c. **Bicycle Seat Neuropathy (BSN):** Explain the natural history of bicycle seat neuropathy (BSN) in cyclists and how a bicycle seat can be altered to improve symptoms.

H. PROSTHETICS & ORTHOTICS IN SPORTS

1. **Perform an H&P and demonstrate familiarity with upper and lower extremity amputations. Become familiar with common orthoses and prostheses, including proper technique for donning and doffing, cost, indications, and its effect on function.**
2. **Be familiar with each general topic below. Additional specific objectives are also listed.**
 - a. **Prosthetic Fitting for Athletes with an Amputee.** Describe the necessary components for a prosthetic prescription. Describe the K levels and prosthetic goals for patients at each K level. Describe the components of upper extremity and lower extremity prostheses. Describe special prosthetic considerations for LE amputees who are active in swimming, fishing, golf, running, and/or skiing. Describe special considerations that need to be addressed during pre-participation physicals for athletes with an amputation.
 - b. **Skin Breakdown in Amputees.** Describe the most common sites of skin breakdown among amputees. Describe the pathophysiology of cholelithiasis (verrucous hyperplasia) and how to manage/treat it. Describe the stages of skin breakdown. Describe prevention strategies and treatment for amputees with skin breakdown, including diet recommendations and activity modification/sports participation.
 - c. **Musculoskeletal Injuries in Amputees.** Describe the sites(s) of peripheral nerve entrapment most common among lower extremity amputees. Describe the pathophysiology, diagnosis, and treatment of neuromas. Contrast the common overuse injuries among active/ athletic upper extremity amputees compared to

active/ athletic lower extremity amputees. Describe strategies for injury prevention, including training considerations, diet, and equipment/prosthetic fitting.

3. **For each general category of orthoses, describe the indications and cost of commonly used types.**
 - a. **Shoulder Orthoses**, including sling and swaths, shoulder immobilizer, and clavicle strap.
 - b. **Hand/Finger Orthoses**, including thumb spica orthosis, neutral wrist orthosis, and ulnar gutters orthosis.
 - c. **Knee Orthoses**, including a neoprene knee sleeve, patellar tracking orthosis, stabilizing knee orthosis, and off-loading knee orthosis.
 - d. **Ankle Orthoses**, including a functional ankle brace (such as ankle stabilizing orthosis), stir-up ankle orthosis (such as air-cast), and compression ankle sleeve.
 - e. **Foot Orthoses**, including a metatarsal pad, heel lift, medial or lateral heel wedge, and carbon fiber, and steel shank insert.

I. THE DISABLED ATHLETE

1. **Perform H&P and demonstrate familiarity with pathophysiology and equipment needs for patients with spinal cord injuries (SCI), amputations, and developmental disorders.**
2. **For each area below, be familiar with the general topic. Additional specific objectives are below.**
 - a. **Pre-participation Physical Examination (PPE).** Describe the recommended setting for performing a PPE for disabled athletes. Describe PPE considerations specific for disabled athletes. Demonstrate familiarity with screening tests and specific restrictions for athletes with Downs Syndrome.
 - b. **Paralympics.** Demonstrate familiarity with the various sports comprising the Paralympics, the athlete disabilities allowed to participate, and the equipment used in each of these sports.
 - c. **Special Olympics.** Demonstrate familiarity with the various sports comprising the Special Olympics and the athlete disabilities allowed to participate in them.
 - d. **Autonomic Dysreflexia (AD).** Describe the pathophysiology, symptoms treatment, and prevention of AD. Describe “boosting” and how it is used by SCI athletes in competitive sports and how this is monitored/detected during competition.
 - e. **Orthostatic Hypotension.** Describe the pathophysiology, symptoms, treatment, and prevention of orthostatic hypotension in SCI patients.
 - f. **Thermoregulation.** Describe the pathophysiology, symptoms, treatment, and prevention of heat illness and hypothermia in SCI patients.
 - g. **Acute and Chronic Injuries.** Describe traumatic and over-use injuries that are common among disabled athletes, including prevention and treatment.
 - i. **Shoulder:** Describe the rationale for higher injury rates in SCI athletes and the specific conditions that are most typical.
 - ii. **Elbow:** Describe the rationale for higher injury rates in SCI athletes and the specific conditions that are most typical.

- iii. **Hand/ Wrist/ Digits:** Describe the rationale for higher injury rates in SCI athletes and the specific conditions that are most typical.
- iv. **Fractures:** Describe the rationale for higher injury rates in SCI athletes and the specific areas that are the most affected.
- h. **Skin breakdown.** Describe risk factors in SCI athletes for skin breakdown and prevention strategies. Be familiar with staging and treatment of skin ulcers.
- i. **Peripheral Nerve entrapments.** Describe common sites for compressive mononeuropathies in wheelchair athletes. Be familiar with treatment and prevention for peripheral nerve injuries.
- j. **Osteoporosis.** Describe what populations of disabled athletes are susceptible to osteoporosis and the related pathophysiology. Describe diagnostic workup, including laboratory testing and imaging, and treatment of osteoporosis in this population. Describe role of imaging to evaluate for fracture in the osteoporotic patient.
- k. **Visually impaired athlete.** Be familiar with the sports where visually impaired athletes can compete and the equipment required for competition. Discuss the interaction required with non-visually impaired athletes working with the visually impaired.

J. EXERCISE AS MEDICINE & INTEGRATIVE SPORTS MEDICINE

1. **Describe the role of the physician in promoting physical activity and demonstrate the ability to write an appropriate exercise prescription for individuals across the spectrum of age, ability, and wellness.**
2. **For each integrative sports medicine approach, describe its theory and principles of practice as well as its commonly employed methods/ techniques. Know the conditions it is commonly used to treat and identify the clinical evidence for its efficacy, where available. Identify contraindications to its use. Additional objectives are below.**
 - a. **Acupuncture.** Describe the differences between traditional vs. contemporary acupuncture in terms of its goal and techniques.
 - b. **Shock Wave Therapy.** Understand the basic science of this modality.
 - c. **Homeopathy and Herbal Remedies.** Especially note those remedies that have been the most widely studied, as well as those that might be used for performance enhancement. Discuss the role of the naturopathic practitioner in sports and rehabilitation medicine.
 - d. **Chiropractic/ Osteopathic.** Describe the most common methods and their possible complications.
 - e. **Massage Therapy.** Know the different types of massage therapy.
 - f. **Alexander Technique.** Describe the role of the Alexander teacher and a basic lesson in this technique.
 - g. **Yoga.** Delineate the most popularly practiced types of yoga. Describe how the Eastern aspects of yoga distinguish it from Western athletic and rehabilitation approaches. Know possible complications of yoga.
 - h. **Tai Chi/ Chi Gong.** Describe the theories behind these practices as they relate to exercise and mental health.

- i. **Feldenkrais Method.** Describe a typical lesson.
- j. **Rolfing.** Discuss how this method specifically targets the fascia, and describe the similarities and differences to massage therapy and traditional physical therapy.

III. BASIC SCIENCE FOUNDATIONS OF SPORTS MEDICINE

A. PATHOPHYSIOLOGY OF TISSUES/ ORGANS

Understand the basic organization of tissue types, with an emphasis on the following aspects of the structural elements below. Know the effect of aging, training, medications, hormones, drugs, nutrition, and therapeutic interventions on these structural elements.

1. Skeletal Muscle

- a. Muscle cell/ fibers, including their types, arrangement/composition.
- b. Muscle contraction, including action potentials, role of actin and myosin, calcium and acetylcholine.
- c. Determinants of strength and response to training and disuse.
- d. Strains, including types and healing rates.

2. Tendons

- a. Basic structure, including paratenon.
- b. Blood supply and healing.
- c. Collagen: types, arrangement, cross-linking.
- d. Elastin: fibroblastic response; metabolic rate of tendon.
- e. Golgi tendon organs.

3. Bone

- a. Bone cells and their function, including osteocytes, osteoblasts, and osteoclasts.
- b. Basic structure and function of cortical vs. trabecular bone.
- c. Blood supply.
- d. Normal vs. abnormal bone formation, including response to stress and inborn errors.
- e. Growth plates.

4. Ligaments

- a. Basic composition, including blood supply.
- b. Sprains: describe types and healing rates.

5. Nerves

- a. Neuronal structure, including axon vs. dendrites.
- b. Fascicular organization, including epineurium, perineurium, endoneurium.
- c. Schwann cell.
- d. Neuron type, including small vs. large, myelinated vs. unmyelinated.
- e. Neuromuscular transmission: pre-synaptic vs. post-synaptic, modulators of membrane potential.
- f. Nerve cell injury, including neuropraxia, neurotmesis, axonotmesis.
- g. Understand the effect of nerve injury on return to play, the role of EMG/ NCS findings, ultrasound vs. MRI findings, bracing, protective devices, surgical vs. non-surgical considerations.

6. Fascia

- a. Basic composition.

- b. Functional/ clinical significance.

B. FUNDAMENTAL BIOMECHANICAL PRINCIPLES

1. General Biomechanics

- a. Compare and contrast isometric versus isotonic versus isokinetic resistance exercises and how they may be implemented in a rehabilitation program.
- b. Describe the difference between concentric and eccentric muscle contractions.
- c. Discuss differences between “open” versus “closed” kinetic chain exercises, give examples of each, and the indication/role for each type of exercise.
- d. Compare and contrast passive, active assisted, and active range of motion.
- e. Compare and contrast dynamic versus static stretching. Review the most appropriate time to stretch, pre- or post- exercise.

2. Lower Limb Biomechanics

- a. Describe the motion planes (sagittal, coronal and transverse) and range of motion for each of the following joints: hip, knee, ankle, foot and first MTP.
- b. Describe the ideal neutral stance position, including alignment of the weight-bearing line through the lower limb.
- c. Describe biomechanical differences between walking and running, including foot contact, stance and swing phase, vertical ground reaction force, and joint motion excursions.
- d. Explain differences between heel strike versus forefoot strike running patterns, including clinical implications of each.
- e. Outline how to counsel patients regarding footwear, including fit, general structure, motion control properties, cushioning, and wear patterns.
- f. Describe how suboptimal lower limb biomechanics may lead to specific injuries, including plantar fasciitis, achilles tendinopathy, lateral ankle sprain, medial tibial stress syndrome, patellar tendinopathy, patellofemoral syndrome and stress fractures.
- g. Describe how biomechanical abnormalities may be managed with orthotics, taping, or bracing.
- h. Describe the biomechanical differences that may predispose female athletes to noncontact anterior cruciate ligament injuries and how teaching appropriate jumping/landing techniques may prevent them.
- i. Describe the biomechanics of cycling, including proper seat height/position for the cyclist and how improper height/position can lead to injury.

a. Upper Limb Biomechanics

- a. Describe the motion planes (sagittal, coronal and transverse) and range of motion for each of the following joints: shoulder, elbow, wrist, and hand.
- b. Describe the phases of throwing with involved muscle activity, including wind-up, early cocking, late cocking, acceleration, deceleration, and follow-through.
- c. Describe the kinetic chain of throwing, including contributions from the legs, trunk, shoulder girdle, and upper limb.

- d. Describe common biomechanical abnormalities demonstrated in pitching and how these may lead to injuries of the shoulder and elbow. Describe which types of injuries most commonly occur in each phase.
- e. Describe common technical errors in specific swimming strokes that are thought to be risk factors for shoulder injury.

C. IMAGING FUNDAMENTALS FOR SPORTS MEDICINE

1. **Approach.** Describe a general approach to imaging, ie. how generally the choice of imaging is influenced by the history and physical exam, and how the results will be integrated into an assessment and plan.
2. **For each of the below diagnostic imaging modalities, describe how it works, general category of use, advantages and disadvantages, and contraindications. Additional learning objectives are below:**
 - a. **Plain radiographs.** Describe the characteristics of a fracture on x-ray. Describe how many radiograph views are required for fracture identification and why. Delineate the appearance of a degenerative joint. Discuss the appearance (or lack) of the major visible structures on radiographs, including, but not limited to air, fluid, bone, cartilage, muscle, calcific deposits, and the major visible organs. Understand the role of fluoroscopy in spinal interventions.
 - b. **Computed Tomography.** Discuss the role of CT in evaluation of injuries – which are likely to benefit from the use of CT as opposed to MRI. Discuss when contrast should be used in conjunction with CT imaging. Identify circumstances when 3D reconstruction would be most helpful. Describe the indications for CT angiography in sports medicine. Delineate the findings of acute intracranial hemorrhage, intra-abdominal visceral injury, and bone healing. Discuss the advantages and disadvantages of using CT for needle guidance.
 - c. **Magnetic Resonance Imaging.** Understand the difference between the different sequences, including T1-weighted, T2-weighted, proton density, and STIR – specifically state how cortical bone, medullary bone, cartilage, tendon, muscle and fluid should appear. Be able to recognize the appearance of tendinopathy, fracture, cartilage injury and fluid collections. Identify the circumstances where MRI provides unique and clinically critical information. Describe when contrast should be used intra-articularly and intra-vascularly. Describe MR neurography.
 - d. **Musculoskeletal Ultrasound.** Identify the characteristic appearance of different tissue types in this modality. Describe the advantages and disadvantages of this modality, including resolution, portability, cost, and accessibility. Describe sonopalpation. See separate Musculoskeletal Ultrasound section for more details.
 - e. **Bone scintigraphy.** Describe the 3 phases of the test. Understand the role in sports medicine centered on detection of stress injury to assess healing. Understand the use of SPECT in conjunction with this imaging modality.
 - f. **Cardiovascular / vascular imaging**
 - i. Echocardiogram indications in athlete.
 - ii. Doppler ultrasonography.
 - iii. Contrast angiography, venography, arteriography (positional).

D. LABORATORY STUDIES IN SPORTS MEDICINE

- 1. Demonstrate an understanding of the correlation and pertinence of routine and specialized laboratory tests with regard to various injuries and sport specific illnesses that a team physician may need to order or encounter under the following circumstances.**
 - a. **Pre-participation**, including routine blood work, genetic testing, anemia-related tests.
 - b. **Endurance Events**, including electrolyte panel, sweat and urine tests, and blood tests for rhabdomyolysis.
 - c. **Cardiovascular Assessment**, including genetic markers of cardiac disease.
 - d. **Pulmonary**, including pulmonary function tests, and metacholine challenge test.
 - e. **Hematologic Disorders**, including sickle cell trait/ disease, Clotting Factor Deficiencies, G6-PD Hereditary Spherocytosis, March hemoglobinuria.
 - f. **Infection**, including Hepatitis, Bacterial, HIV, HSV, Bite wounds, STDs, Heterophile antibody (monospot)/throat culture, EBV specific antibody; HIV testing, including legal requirements.
 - g. **Diabetes**, including Hgb A1C, Glycosylated Hgb, Glucose tolerance test, Casual plasma glucose vs fasting, and routine labs.
 - h. **Other Endocrine Considerations**, including pregnancy test, testosterone levels, gnrh, FSH,LH (karyotypes) Prolactin, TSH,Free Thyroxine, Calcium Progestin-withdrawal.
- 2. Understand tests for blood doping/ banned substances/ ergogenic aides**, including Hematocrit levels, EPO, electrolytes, liver function tests, lipid profile, HGH, U/A, Urine screens, Uric acid, Testosterone/Epitestosterone ratio, Gas Chromatography/ Radioimmunoassay/ Mass Spectrometry.

E. MEDICATIONS COMMONLY USED IN SPORTS MEDICINE

- 1. Familiarize yourself with the common banned substances in competitive sports, such as may be found on the “NCAA Banned Drugs” list, as well as those which require declarations of use rather than therapeutic use exemptions (TUE).**
- 2. For each class of medication be familiar with mechanism of action, appropriate use, and common and severe adverse medication effects. Additional objectives below.**
 - a. **Non-steroidal anti-inflammatory drugs (NSAIDs)**
 - i. Identify the primary mechanism of NSAIDs action for reduction of pain and inflammation.
 - ii. Name medications that can be administered in conjunction with NSAIDs to reduce likelihood and severity of some of the common adverse effects associated with NSAID use.
 - iii. Describe a potentially severe electrolyte abnormality which can be associated with NSAID use.

- iv. Describe the role of NSAID administration in association with muscle contusion.
- v. Explain why NSAID use may be more appropriate during the acute phase of injury recovery but may be contraindicated in later stages.
- vi. Describe the role of topical NSAIDs.

b. Injectables

- i. Understand the side-effects and risks associated with injection of corticosteroids.
- ii. Know the role and efficacy of injectable corticosteroids in conditions typically encountered in sports medicine (e.g., acute injury, osteoarthritis, chronic tendonopathy).
- iii. Be aware of the different formulations and administration schedules available for injectable hyaluronic acid, as well as risks and benefits of each.

c. Asthma Medications

- i. Be familiar with the sports which have the highest prevalence of exercise induced bronchospasm (EIB).
- ii. Know the role of short- and long-acting β -agonists, as well as other classes of asthma medications (leukotriene receptor antagonists, mast cell stabilizers, etc.) in the management of EIB.
- iii. Recognize common detrimental effects β -agonists can have on performance.
- iv. Identify which inhaled β -agonist combinations are permitted by the NCAA versus those permitted by the World Anti-Doping Agency (WADA).

d. Cardiovascular Medications

- i. Identify why diuretic agents should be avoided or used only with caution in athletes, explicating potential adverse side effects and their potential use for illicit purposes.
- ii. Understand why β -blockers are prohibited in certain precision sports (e.g., archery). Explain how β -blockers may adversely affect athletic performance (cardiac output, V_{O2max} , cardiac output, fuel use, thermoregulation, skeletal muscle recruitment patterns), and understand the role of selective β -blockers.
- iii. Given the potential problems with diuretics and β -blockers, suggest alternative anti-hypertensive medications that may be a better choice in athletes.
- iv. Identify the most significant potential risk associated with using statins in athletes.

e. Antibiotics

- i. Understand the potential risks of prescribing fluoroquinolones for athletes.
- ii. Know the first-line agents for treatment of community acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA).
- iii. Know how treatment of CA-MRSA can contribute to the development of infectious diarrhea.
- iv. Be familiar with the role of decolonizing agents in the management of CA-MRSA.

f. Stimulants

- i. Be familiar with stimulant medications commonly used to treat ADHD.

- ii. Understand the advantages athletes may derive from stimulant medications and restrictions on their use as proscribed by the International Olympic Committee (IOC) and the WADA.
- g. **Oral contraceptive pills (OCPs)**
 - i. Understand the role of OCPs in the treatment of menstrual irregularities associated with the female athlete's triad.
 - ii. Be familiar with the role of OCPs in potentially reducing the risk of stress-fractures.
 - iii. Know the potential severe adverse/life-threatening side-effects associated with OCP use, as well as those which may affect performance.
 - h. **Allergic rhinitis**
 - i. Identify first-line treatments for allergic rhinitis.
 - ii. Be aware of restrictions on medications such as pseudoephedrine and other over-the-counter treatments which athletes may use as self-treatment for symptoms associated with allergic-rhinitis.
3. **Doping control.**
- a. Be familiar with the varying agencies (World Anti-Doping Agency [WADA], United States Anti-doping Agency, USADA, NCAA), which monitor and govern the use of illicit substances by athletes, including the sports-specific anti-doping organizations.
 - b. Understand the requirements for a valid therapeutic use exemption (TUE).

IV. SPECIAL TOPICS WITHIN SPORTS MEDICINE

A. PREVENTION & SCREENING, INCLUDING PPE

Describe the contents of the standard Pre-participation Exam (PPE) form found on the American Medical Society for Sports Medicine (AMSSM) site at <http://www.amssm.org/Publications.html>, especially the historical questions related to cardiovascular risk. Additional objectives are below.

1. Identify the goals of the PPE, including forming a therapeutic alliance with the athlete, and the different types of prevention.
2. Identify the major cardiovascular, pulmonary, medical, neurological and musculoskeletal injuries that can predispose to loss of life, limb, other morbidity, or diminished sports function should be sought first. Describe the diagnoses that disqualify an athlete from safe participation in contact sport.
3. Describe the cost and benefits of the different types of cardiac screening modalities.
4. Be familiar with what referral resources a PPE team should have access to.
5. Describe the pros and cons of a station-based PPE.
6. Know the most common problem areas for individual sports.
7. Identify resources for determining age-appropriate expectations for vital signs and functioning.
8. Describe resources to direct athletes for recommendations for performance improvement.
9. Be familiar with timing of need for repeating physical exams.

10. Describe basic principles of return to play for previously injured athletes.
11. Be able to direct appropriate sports return based upon prior injuries/ surgeries.
12. Understand the best practice for concussion baseline testing at the high school collegiate and professional levels.

B. SIDELINE COVERAGE & SPORTS MEDICINE EMERGENCIES

1. **Staff and responsibilities.** Discuss the importance of the team physician knowing the affiliated staff (coach, athletic director/ event director athletic trainers, EMT, event security, other physicians) and their roles, as well as having a clearly recognized chain of command on and off the field.
2. **Location and Supplies.** Articulate the importance of knowing the venue address, nearest hospital, floor plan/field layout, location of AED, spine board, ambulance, etc. Identify appropriate equipment kit.
3. **Communication & Protocolization.** Describe the role of established protocols for evaluation, treatment, and disposition of injuries, including an Emergency Action Plan. Discuss appropriate technology for communication among staff. Identify the importance of protocols for clearing injury area to protect the injured and treating staff, especially during races. Discuss the importance of protocol review and practice in event preparation.
4. **Emergencies.**
 - a. Know what the specific needs are among staff regarding BLS, ACLS, and ATLS certification.
 - b. Describe the prioritization protocol in injuries referenced by the ABCDEF acronym (Airway, Breathing, Circulation, Disability, Exosure, Final Disposition), and for each of the below types of injuries, discuss how to apply the ABCDEFs.
 - i. Head and neck injuries: mild TBI, spinal cord injuries.
 - ii. ENT injuries.
 - iii. Cardiac events – sudden cardiac arrest.
 - iv. Thorax – pneumothorax, exercise-induced bronchospasm.
 - v. Abdominal, Pelvic, and Genitourinary Injuries.
 - vi. MSK and extremity injuries.
 - vii. Environmental and miscellaneous emergencies, including heat and cold exposure and anaphylaxis.

C. PRIMARY CARE SPORTS ISSUES

For the below body systems, be familiar with the common conditions listed below, including presentation, treatments, effect on athletic participation, and return to play policy.

1. **Cardiac.** Myocarditis, hypertension, hypertrophic cardiac myopathy, long q-t syndrome, cardiac arrhythmias, cardiac murmurs, marfan's syndrome.
2. **Respiratory.** Dyspnea, asthma, exercise induced bronchospasm, vocal cord dysfunction, exercise induced anaphylaxis.
3. **Gastrointestinal.** Acute gastroenteritis, peptic ulcer disease, delayed gastric emptying, runners diarrhea, lower gi bleeding, acute hepatitis, hepatosplenomegaly.
4. **Endocrine.** Diabetes, including Type I and II; hypothyroidism, hyperthyroidism.
5. **Renal and Genitourinary.** Hematuria, proteinuria, acute renal failure,

- nephrolithiasis, stress incontinence, genital injuries, urinary tract infections, direct injuries – testicular trauma, penile trauma, vulva trauma.
6. **Hematology/ Immunology.** Sickle cell trait, venous thromboembolism, anemia: sports dilution, iron-deficiency.
 7. **Infectious Disease.** URI's, infectious mononucleosis (note especially return to play guidelines), influenza, herpes simplex, STD's (chlamydia, gonorrhea), blood born pathogens (HIV, hepatitis B, hepatitis C).

D. SPORTS DERMATOLOGY

For each skin lesion, be able to accurately describe and identify. Additional objectives are below.

1. **Environmental Injuries.** Describe appearance, treatment, and prevention of environmental injuries including, sunburn, frostnip/frostbite, and chilblains (perino).
2. **Urticaria.** Describe the treatment of the various types of urticaria, including acquired cold urticarial, solar urticaria, aquagenic urticaria, and exercise-induced urticaria.
3. **Skin infections.** Describe the typical symptoms, examination findings, testing, pathogen, treatments, and restrictions from competition/practice (if any).
 - a. Impetigo, Folliculitis.
 - b. MRSA, Abscess, Furnunculosis . Describe the specific procedure for performing an I&D for treatment of an abscess.
 - c. Cellulitis.
 - d. Scabies.
 - e. Molluscum Contagiosum.
 - f. Herpes gladiatorum.
 - g. Tinea Corporis/Pedis.
 - h. Warts.
 - i. Swimmers' ear.
 - j. Swimmer's itch.
 - k. Sea-bather's eruption.
4. **Skin Lacerations.** Describe the initial wound management and evaluation of skin laceration. Describe the specific procedure for suturing a laceration to the face/scalp and trunk. Discuss what suture material is recommended for trunk, extremity/scalp, and facial lacerations. Describe common suturing techniques and the indications for each. Describe the specific procedure for applying tissue adhesives (Dermabond) to a laceration and any contraindications to this.
5. **Auricular Hematoma (Cauliflower ear).** Describe the typical appearance, cause, and treatment.

E. MUSCULOSKELETAL ULTRASOUND

1. **Be familiar with the American Institute of Ultrasound Medicine (AIUM) guidelines for musculoskeletal ultrasound found at:**
<http://www.aium.org/resources/guidelines/musculoskeletal.pdf>
2. **Basics Principles**
 - a. Understand the relative strengths and weaknesses of musculoskeletal (MSK) ultrasound in comparison to other imaging modalities. Be able to discern appropriate circumstances for use of MSK ultrasound.

- b. Be familiar with the basic principles of impedance, reflection, refraction, and absorption as it relates to musculoskeletal ultrasound.
 - c. Define echogenicity, and understand the descriptive terms anechoic, hypoechoic, and hyperechoic.
 - d. Understand anisotropy/the anisotropic effect, and how to account for it when using MSK ultrasound.
 - e. Understand other common ultrasound artifacts such as reverberation, acoustic shadowing, and through transmission.
 - f. Understand how frequency, resolution, and attenuation affect ultrasound imaging.
 - g. Be familiar with the basic knobs of the ultrasound machine and their functions.
 - h. Understand the role of adjusting depth, gain, focal zones, and time gain compensation (TGC) on images obtained.
 - i. Understand the role of Doppler imaging in MSK ultrasound including their role in assessing neovascularization.
3. **Basic Technique**
- a. Familiarize yourself with how to make appropriate transducer selection.
 - b. Know the role of ultrasound gel.
 - c. Recognize the importance of anchoring the hand during scanning.
 - d. Be familiar with conventions of transducer positioning (i.e., left and right on screen in relation to transducer orientation and anatomic positions such as proximal, distal, medial and lateral).
4. **Imaging**
- a. Familiarize yourself with the normal ultrasonographic appearance of typical structures encountered in MSK ultrasound (e.g. muscle, tendon, ligament, nerve, vessels, and bone).
 - b. Be able to scan and obtain images for the 6 major regions of the body as recommended by the AIUM Practice Guidelines for MSK US (shoulder, elbow, wrist/hand, hip, knee, foot/ankle).
5. **Intervention**
- a. Be familiar with the principles and techniques of injection and other interventions commonly performed in a Sports Medicine office.
 - i. Understand the different techniques involved in needle guidance in-plane vs. out of plane relative to the transducer.
 - ii. Perform basic interventional injections to areas that require ultrasound guidance for correct placement (i.e. hip joint, biceps tendon sheath, glenohumeral joint, etc.).

F. COMMUNICATION & TEAMWORK IN SPORTS MEDICINE

Understand the following important topics/ principles.

1. **General Communication.** Describe common pitfalls associated with improper and adverse forms of communication. Understand the importance of setting “on-call” expectations with your ATC and setting consistent times for training room sessions. Learn that it is the responsibility of the team physician to blend into the Training Room Environment.

2. **Availability.** Discuss the importance of physician availability. Identify the sports with highest risks of injury. Learn to triage communication in an effective, accurate, and efficient manner.
3. **Teamwork.** Understand the importance of developing relationships with the team's ATCs, Head Coaches, and any other medical personnel that may assist in treating your athletes.
4. **Emergencies.** Describe the important elements of an Emergency Action Plan (EAP), including how they might be different for different venues. Please see Sideline Coverage and Sports Medicine Emergencies section.
5. **Chain of Command.** Describe the importance of having a predetermined chain of command, including a single person who will be the voice of the medical staff. Appreciate that the Head Certified Athletic Trainer is the liaison between the head coach and the Physician. Explain why communication from the Head Team Physician to the Director of Athletics (at the Collegiate Level) can be considered reasonable if an emergency situation occurs. Know that emotions are heightened during games and protocols are established during pre-season planning to avoid miscommunication.
6. **Media.** Understand the role of the team physician regarding relations with the media and the mechanism for communicating information. Recognize the importance of speaking with "one voice" as medical providers. Understand that Social Media has changed the speed at which information can be delivered.

G. ETHICAL & MEDICO-LEGAL ASPECTS AND PROFESSIONALISM IN SPORTS MEDICINE

Understand the following important topics/ principles.

1. **Advocacy.** Explain the role of the team physician, specifically identifying for whom she is an advocate.
2. **Autonomy.** Describe the role of the team physician in providing informed consent to the athlete and the importance in making decisions in the context of the player's personal goals and preferences.
3. **Liability.** Understand the importance of limiting unnecessary liability for the team physician or the institution. Describe why a physician may or may not be covered to take care of her student-athletes when they are out of state, and identify resources to check individual state rules. Identify what rules govern the liability of physicians caring for other teams' players, spectators, or other staff members.
4. **Confidentiality.** Describe HIPAA and FERPA. Understand how the physician's relationship with the school or professional club inhibits the normal strict rules governing doctor-patient confidentiality. Describe how the physician's responsibility regarding giving players advance notice of any potential sharing of medical information.
5. **Minors.** Describe when and how parents should be involved in their child's training and care and when parental permission needs to be obtained.
6. **Professionalism and Ethics.** Describe the important qualities of a team physician, including altruism, honesty, compassion, integrity, and respect. Describe the physician's responsibility to self, patient, institution, and medical profession.
7. **Prevention.** Discuss the role of the PPE (see Screening & Prevention section above)

8. **Infectious Disease.** Describe the role of the physician in limiting the spread of infectious diseases (see Primary Care Sports Medicine section above).
9. **Drugs and the Athlete.** (See Medications Commonly Used in Sports Medicine section above).