J Pediatr Adolesc Gynecol (2005) 18:9–15

Mini-Review

Sports Medicine and the Adolescent Female

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Key Words. Female athlete—Sports medicine

Background Information

There is a general trend toward increased participation of females in sports and physical activity. Although women were banned from the first modern Olympic games in 1896, they comprised 35.1% of the participants by 1996. There were a few early pioneers, including Olympic champions Charlotte Cooper and Mildred "Babe" Didrikson, but WWII probably had greater influence on society's acceptance of the female athlete. With men away at war, the women were called upon to accomplish all types of physical tasks on the home front. The WWII depiction of "Rosie the Riveter" as well as the success of the All American Girl's Baseball League redefined "appropriate" roles for women. The trend of increased female participation in athletics escalated in the last half of the twentieth century when in 1972, Title IX of the Educational Amendment Act allowed for equal access to all federally funded activities including school-sponsored sports. The 1980s saw a 700% increase in participation of women and girls in sports and another 50% increase was seen in the 90s. One in 27 high school girls participated in sports in 1972. This number increased to 1 in 3 by 1998, a 40% increase from 1988. Currently, an estimated 30 million children and adolescents participate in organized sport each year in the United States. More and more research is revealing the tremendous benefits of exercise in young women, but there are some increased concerns as well. Given the explosion of female athletic participation, it is imperative that physicians understand not only the benefits, but also the orthopedic and medical challenges that specifically apply to young women in sports.

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Benefits of Exercise in Females

There are an estimated 200,000 deaths annually in the US related to a sedentary lifestyle. Several studies have revealed that physical fitness is associated with dramatic reductions in all causes of mortality. While patients and physicians alike are most familiar with the positive cardiovascular affects of exercise, the benefits extend beyond the heart. Increased physical activity is associated with additional benefits such as, decreased risk of diabetes, breast cancer, and even depression. Starting a regular exercise routine in adolescence can have a huge effect on overall health status later on. That said, it should be noted that one does not have to wait until adulthood to see the benefits of regular exercise. It has been shown that high school girls who are active in sports have higher graduation rates, fewer unwanted pregnancies, and greater self-esteem than those who are not active. Physical activity positively influences almost every aspect of a young woman's health from her physiology to her social interactions and mental health. See Table 1.

Orthopedic Issues in Active Adolescents

Evaluation of an Active Female with Musculoskeletal Complaints

History. Though athletes with orthopedic problems occasionally present with a sense of joint instability, early muscle fatigue, or decreased power, the usual chief complaint is "pain." With this in mind, the majority of the musculoskeletal history is not that different from the history taken for chest or abdominal pain. One needs to ask about onset, quantity, quality, and duration of the pain, contributing and alleviating factors, and associated symptoms. A few unique, yet

1083-3188/05/$22.00
doi:10.1016/j.jpag.2004.11.005

Table 1. Probable Benefits of Exercise in Adolescent Females: (*immediate)

*Decreased "risky" behavior including involvement w/ drugs, smoking and teen pregnancy
*Improved self image, self esteem and mental health
*Improved bone mineral density w/ decreased long term risk of osteoporosis
*Improved lipid profile and control of obesity
*Less dysmenorrhea and premenstrual tension syndrome
*Improved immunity
*Improved glycemic control and prevention of type 2 diabetes
Decreased all-cause mortality
Decreased risk of coronary disease, cardiac events, and death
Slower progression of early carotid atherosclerosis and a reduction in stroke risk
Improved blood pressure control
Decreased rate of cholelithiasis
Modest protection against breast cancer
Decreased disability and improved cognitive function and autonomy in older women
Decreased health-related costs

important historical questions to ask include: mechanism of injury, predisposing factors, and goals of treatment. Mechanism of injury refers to the inciting event that caused the current complaint. With traumatic events, this is typically straightforward. The patient athlete with an acute wrist fracture, for example, may describe a fall onto an outstretched hand. Someone with a meniscus tear may describe a twisting injury of the knee. The mechanism of injury can be a key component in developing a differential diagnosis and will help guide your physical exam. For overuse injuries, mechanism of injury may not be as important per se as predisposing factors. Factors that may influence these conditions include previous injury, anatomical and biomechanical issues, and a change in routine, equipment, or training intensity. In addition to questions regarding the patient's current and previous status, it is extremely important to ask a patient about their goals of treatment. Because many of these problems are not life-threatening, different treatment options may be acceptable depending on the injury. A "jammed" finger to a soccer player may be a mild annoyance whereas the same injury to a softball pitcher can be devastating. The patient's goals will help you decide the appropriate level of aggressiveness. A review of systems, focusing on neurologic, rheumatologic, and systemic complaints should be included. In the active young woman, knee pain is often an overuse injury, but rarely could be the herald sign of Multiple Sclerosis, a collagen vascular disease, or even hematologic malignancy. Menstrual history is particularly important in the adolescent athelete. It can be used as a general indicator of skeletal maturity that may be a significant factor in many conditions. Additionally, amennorhea (primary or secondary) can be a serious reason for concern in this population as will be discussed later. Finally, sources of referred pain should be considered, such as an ovarian cyst causing groin or low back pain.

Physical Examination. Key components of the musculoskeletal physical exam are listed in Table 2. In addition to these essential items, a general exam for signs of rheumatologic or other systemic illness should be considered. Also, a brief evaluation of the joints above and below the injured area/joint should be performed.

Common Injuries in Female Athletes

As with males, the overuse to traumatic injury ratio for females is approximately 50:50. Type of injury is most closely linked to the type of sport. Knee and ankle problems are common in running sports, whereas shoulder complaints are more common in swimming, crew, and throwing sports.

Despite similar injury rates in comparable sports, there is data to suggest that females may be at increased risk for specific injury types and patterns. Aside from obvious anatomic differences, there are several factors that may influence injury patterns including: differences in metabolism, circulation, and cardiorespiratory capacity, body shape, size, and composition, and others. It has been proposed, for example, that increased Quadriceps angle (Q angle), less developed vastus medialis, and a greater degree of genu valgum in the female knee contributes to the higher rate of patellofemoral disorders. Hormonal influences and differing neuromuscular reflex patterns among other factors have been implicated in the two to eightfold increased risk for non-contact ACL injuries.

While a full tutorial on evaluation and treatment of specific injuries is beyond the scope of this paper, Table 3 shows the typical presentation, signs and symptoms of some of the more common injuries seen in young female athletes. There are a number of excellent resources/ texts to further complement your knowledge

Table 2. Components of the Musculoskeletal Physical Exam

Inspection – Look for deformity, ecchymosis, muscle atrophy
Palpation – Feel for swelling/effusion, tenderness, warmth
Range of Motion (ROM) – Test for pain/disability with both active and passive motion
Manual Muscle Testing (MMT) – Evaluate for weakness (and pain) by resisting muscle action
Special Tests – Check the integrity of a specific structure, (ligament, cartilage, tendon, bone) by challenging its function or by "aggravating" the structure and reproducing pain
Neurovascular tests – In acute injury, rule-out nerve and vessel damage. In overuse injuries, evaluate for associated or contributing neuropathy

Table 3. Some Common Injuries in Female Athletes

Diagnosis	Presentation	+ Exam Findings	Radiographs	Initial treatment
Overuse injuries				
Patello-femoral Pain/ lateral patella tracking	-Peripatellar/ anterior knee pain exacerbated by running, stairs, prolonged sitting -Occasional swelling after activity	**I:** +/− genu valgus overpronation **P:** Peripatellar tenderness **MMT**: Weak quads; +/− Hip weakness, tight IT band **Spec Tests**: Apprehension and pain w/ lateral patellar glide	-X-rays: Weight bearing AP and lateral and merchant views – evaluating for joint space narrowing and patella position	-PRICE (protect, rest, ice, compress, elevate) -PT (quad strengthening) -Patellar stabilization brace -Address biomechanical factors
Shoulder Instability	-Shoulder pain or fatigue after overhead activity -+/− Hx of episodic subluxation or frank dislocation	**I:** +/− scapulo-thoracic dysrhythmia **P**: minimal tenderness **ROM**: May be incresed **MMT**: Rotator cuff (RTC) weakness **Spec Tests**: apprehension w/ Jobe disloc/relocation test, increased ant/post translation, + O'Brien's test for labral tear if associated **NV**: rule out cervical spine pathology	-X-rays: (may include: True AP, Axillary lateral, west point view, strycher notch view…) to evaluate for bony pathology -MRA if labral injury is suspected	-PRICE -PT (RTC strengthening, scapular stabilization) -Consider surgery for unidirectional, involuntary instability, or failed conservative treatment
Tibial Stress Fracture	-"Stabbing" Shin pain that initially was w/ impact activity only, now w/ any activity -No obvious acute injury -+/− Night pain	**I**: +/− swelling, ecchymosis **P**: point tenderness **MMT**: Anterior tibial weakness **Spec Tests**: Bony pain at tender site w/ tapping either proximally or distally	-X-rays: AP and Lateral to eval for obvious fracture -Bone Scan or MRI for early diagnosis	-Rest from impact activity -Pneumatic compression (eg "aircast") -PT -Address predisposing factors -**Anterior tibial stress fx: non-wt. bearing, immobilize, refer to specialist
Spondylo-lysis (pars fracture)	-Low back pain worse with hyperextension -No radicular symptoms	**P:** +/− Tenderness over lumbar spine **Spec tests**: increased pain w/ single leg hyper-extension maneuver, - straight leg raise, + FABER if associated sacroiliac joint pain **MMT**: hip and abdominal muscle weakness, tight hamstrings	-X-rays: AP, lateral and oblique lumbosacral films to evaluate for fx, spondylolisthesis -Bone Scan for early diagnosis and eval. of healing probability -+/− CT scan	-Aviod hyperextension -Brace when bone scan + to allow healing -PT when pain free (or immediately w/ neg bone scan)
Traumatic injuries				
ACL tear	-Sudden onset swelling and pain (deep, med or lat depending on associated injuries) after a twisting injury to the knee -Often there is a sense of instability	**I**: Effusion, **P**: Tenderness depends on associated boney, meniscal, and collateral ligament injury **ROM**: limited (by effusion or mechanical block) **Spec tests**: + Lachman and Ant. drawer (increased ant. tibial translation on femur), + pivot shift (rotational instability) **MMT**: Decreased quad strength	-X-rays: AP, lat and merchant views to R/o fracture, assess growth plates in adolescents -MRI may be used to confirm diagnosis and evaluate for other pathology	-PRICE -Brace if there is significant instability -PT (increase ROM, decrease swelling, Quad atrophy) -Orthopedic referral

(Continued)

Table 3. Continued

Diagnosis	Presentation	+ Exam Findings	Radiographs	Initial treatment
Ankle sprain	-90% are lateral/ inversion injuries. -+/− inability to bear weight dep on severity -Complaints of instability, swelling, ecchymosis is variable	**I**: swelling, ecchymosis **P**: Tender over affected ligaments. Suspect fx w/ bony tenderness. **ROM**: Limited **Spec tests**: +/− Anterior drawer and talar tilt tests for lateral ligament injury. Note, w/ ant/med pain, special tests for syndesmotic injury ("high ankle sprain) should be performed. **MMT**: decreased strength **NV**: R/o peroneal n. injury w/ inversion sprains	-X-rays: AP, lat and mortise views to r/o fracture if bony tenderness is present -Weight bearing mortise view to evaluate syndesmosis injury	-PRICE -Crutches prn comfort -Walking boot vs. pneumatic compression (eg aircast) for stability -PT (ROM, strength, balance) -Consider functional brace for accelerated return to activity
Patella dislocation	-Acute, severe anterior knee pain and swelling after the patella "shifts out of place" -Traumatic vs. non-contact -Continued sense of instability	**I**: Swellng, erythema **P**: Effusion, severe peri-patellar tenderness **ROM**: Limited by pain, effusion **Spec tests**: ++ Apprehension (and pain) with lateral patellar glide test **MMT**: Quad weakness, r/o tendon rupture	-X-rays: to r/o Fx and evaluate patellar position. -Consider MRI if chondral injury suspected	-PRICE -Immobilize in extension -Consider early specialist (sports med or orthopedic) referral for conservative vs surgical management
Concussion	-Reported (or observed) symptoms after minor head injury may include: headache, nausea, fatigue, dizziness, light or noise sensitivity, memory or concentration problems, and others	-Loss of consciousness (LOC) may or may not be observed. -Cognitive testing may reveal retrograde or anterograde amnesia, problems w/ concentration, decreased reaction time, etc -Findings can be subtle -Neuro exam is usually non-focal	CT (or MRI) should be considered in cases of LOC, amnesia, severe, accelerating or prolonged symptoms, or in cases w/ focal neuro findings on exam	-Remove from exertion/ sport until symptom free -Consider formal neuropsych testing w/ refractory sx

in these areas. With overuse or traumatic injury, early recognition, treatment, and if necessary, sports medicine or orthopedic consultation is paramount to prevent further injury and minimize time lost from sport participation. It is important to note that for overuse injuries, rest alone is typically insufficient. Addressing inflammation, muscle weakness, inflexibility, and/or biomechanical factors allows return to activity with decreased risk of re-injury. Many traumatic injuries, even some fractures and ligament tears are best treated non-surgically, but good outcomes require early appropriate management. If ever there is a question as to whether a patient athlete may benefit from surgical management, referral to a specialist should not be delayed.

General Guidelines for Injury Management

Whether injury is secondary to acute trauma or overuse, the general management principles hold true. These are listed in Table 4.

Medical Issues

The Female Athlete Triad

The term Female Athlete Triad refers to the combination of disordered eating, amenorrhea, and osteoporosis. These conditions are often interrelated and

Table 4. Injury Management

1. PRICE = Protect, Rest, Ice, Compress, Elevate. PRICE is initiated to:
   - Minimize initial injury
   - Decrease pain and swelling
   - Prevent further tissue damage
2. Maintain flexibility, strength, and proprioception, and overall fitness during healing
3. Functionally rehabilitate injured patient to enable return to activity
4. Assess and correct any predisposing factors to decrease the likelihood of recurrence

associated with athletic training. The exact prevalence of the female athlete triad is unknown, but studies have reported disordered eating behavior in 15 to 75% of adolescent athletes. Many athletes do not meet the strict DSM IV criteria for anorexia or bulimia but will manifest a wide range of harmful behaviors, from food restriction to binging and purging, and diet pill or laxative abuse in order to lose weight or maintain a thin physique. Disordered eating can be seen in athletes participating in all sports, but those women and girls involved in sports that emphasize low body weights are especially vulnerable. Particularly "high risk" sports include gymnastics, crew, swimming, dance, running, and equestrian sports. Disordered eating can impair athletic performance and increase risk of injury. Medical complications can include menstrual dysfunction and irreversible bone loss (as in the female athlete triad) as well as some potentially fatal changes in the cardiovascular, endocrine, and thermoregulatory systems.

Amenorrhea occurs in 3.4% to 66% of adult female athletes (depending on the population studied and inclusion criteria used), compared with only 2% to 5% of women in the general population. These issues often go unreported and unrecognized because of the secretive nature of disordered eating behavior and because of the commonly held belief that amenorrhea is a normal consequence of exercise. Athletic amenorrhea (primary or secondary) is typically classified as hypothalamic induced menstrual dysfunction, identified with abnormal LH and GnRH levels. There are likely many contributing factors including psychologic stress, genetic predisposition, low body fat, and over training. One of the main theories as to the etiology of athletic amenorrhea, however, is that nutitional needs are not met, causing an "energy drain" and resultant hypothalamic dysfunction. Delayed menarche, prolonged secondary amenorrhea, and even oligomenorrhea may represent a prolonged hypoestrogenemia which can contribute to decreased bone density, osteopenia, and eventually osteoporosis.

The majority (50 to 63%) of the peak bone mass is achieved during childhood and the rest (37 to 50%) during adolescence. Thus, young women who lose bone mineral density due to the hypoestrogenism associated with amenorrhea may never recoup that loss. Low bone mineral density puts the athlete at risk for stress fracture as well as more devastating fractures of the hip or vertebral column.

Treatment of the Female Athlete Triad requires a multidisciplinary and multifactorial approach. Estrogen replacement (in the form of OCP) remains controversial. Some research suggests that hormonal replacement (with >50mcg estrogen per day) will prevent some bone loss. The criteria for initiating estrogen replacement therapy and the optimal dosing schedule have not been determined, but the American Academy of Pediatrics recommends supplementation for amenorrheal adolescents if they are three years postmenarche and older than 16 years of age. A younger age is permitted for initiation if she has had a stress fracture. Other treatment considerations should include a change in activity to decrease overall energy expenditure, nutrition consultation, calcium and vitamin D supplementation, and psychologic counseling. In addition to health care professionals, the role of family members, teachers, trainers, and coaches in the athlete's recovery should not be underestimated.

Pregnancy

While teenage pregnancies are less common in those involved in athletics, it does occur, thus physicians who treat adolescent females regularly need to be aware of the issues and current recommendations. The literature notes that exercise in general is not harmful to the pregnant female or her fetus. There is also evidence to suggest that regular exercise throughout an uncomplicated pregnancy can be beneficial to both mother and baby. Maternal benefits may include improved mental state, limited weight gain, and decreased risk of gestational diabetes, easier delivery, and improved overall fitness. Fetal benefits may include improved stress tolerance, decreased body fat, and advanced neurobehavioral maturation. Concerns have been raised that fetal hypoxia could occur as a result of blood being shunted from the placenta to exercising muscles or that exercise will raise core temperature and harm the fetus. Current data does not support these concepts. The morphologic and physiologic changes of pregnancy may, however, interfere with sports performance and safety. The American College of Obstetricians and Gynecologists guidelines for exercise during pregnancy state that "in absence of either medical or obstretric complications, 30 minutes or more of moderate exercise a day on most, if not all, days of the week is recommended for pregnant women." Absolute contraindications to exercise in pregnancy are listed in Table 5. Activities with a high risk of trauma should be

Table 5. Absolute Contraindications to Exercise in Pregnancy (ACOG Committee Opinion Jan 2002)

Hemodynamically significant heart disease
Restrictive lung disease
Incompetent cervix/cerclage
Multiple gestation at risk for premature labor
Persistent second or third trimester bleeding
Placenta previa after 26 weeks gestation
Premature labor during current pregnancy
Ruptured membranes
Preeclampsia/pregnancy-induced hypertension

avoided as well as scuba diving and exertion at extreme altitude. The supine position and prolonged motionless standing should be discouraged after the first trimester because of decreased venous return and subsequent decreased cardiac output. Women participating in jumping activities should be advised that they may be predisposed to pelvic ligamentous injury. This is thought to be due to the effects of the hormone relaxin. Return to full activity after delivery may decrease the risk of postpartum depression and is known to be safe for both mother and the breast feeding baby. Return to athletics should be gradual because of deconditioning and the known 4–6 week period it takes to get back to the pre-pregnancy physiologic and morphologic state.

Anemia in the Athlete

There are several causes of decreased hematocrit in athletes, including; pseudoanemia (decreased HCT secondary to plasma expansion), iron deficiency anemia, "foot-strike" or exertional hemolysis, anemia of malnutrition (in eating disordered athletes), and exercise related GI bleeding. Of these, the most common cause of true anemia in athletic females, as in the general population, is iron deficiency. Many female athletes, especially "low weight" athletes (e.g., ballet dancers, distance runners, gymnasts), consume fewer calories and insufficient iron to make up for their menstrual loss. The small amounts of iron lost in urine and sweat during exercise is likely insignificant. Minor gastrointestinal bleeding can occur in some distance runners, cyclists, and triathletes from superficial stomach "stress ulcers" or from "ischemic colitis" when blood is shunted from the gut to working muscles. Diagnosis of iron deficiency anemia is made with serum findings of low hematocrit, ferritin, and MCV, and blood smear findings of hypochromic, microcytic erythrocytosis. Low ferritin without anemia has not been found to significantly affect sports performance, but true iron deficiency anemia, even mild, can affect athletic performance and treatment should be considered. To differentiate between iron deficiency anemia and pseudoanemia with low ferritin, a two month trial of iron therapy is appropriate, looking for a minimum 1g/dl increase in hemoglobin. See Table 6.

Table 6. Recommendations for Prevention of Iron Deficiency Anemia

Increase intake of lean red meat, dark chicken, and iron fortified cereals etc
Combine poultry or seafood with dried beans or peas
Enhance iron absorption by avoiding caffeine and increasing vitamin C intake
Cook acidic foods in cast iron cookware
Consider menstrual manipulation w/ OCPs in cases of menorrhagia
Consider supplementation with ferrous sulfate (325mg 3x/wk) in the athlete with recurrent anemia.

The Breast and Sports

Exercise can lead to breast injury and discomfort through increased motion, friction, and less commonly, blunt trauma.

Pain from excessive breast motion is very common in active women, particularly those with larger breasts. This problem is often underreported, especially in the adolescent, because of embarrassment and fear. In one study, 31% of female athletes surveyed reported general exercise-induced breast discomfort, whereas 52% of the same group noted specific injury and pain secondary to sport involvement. Several sports, such as running, basketball, volleyball, and equestrian activities can lead to significant breast displacement and painful stress on the fascial attachments to the pectoralis muscle. Such breast injury can be reduced and often prevented by wearing a properly fitted sports bra. The bra should lift and separate the breasts, limiting motion as much as possible. It should be made of nonabrasive, "breathable" material. Bra and shoulder strap padding may be necessary depending on breast size and type of sports activity.

The nipple is a common site of abrasion injury in active females. This is especially true for those women involved in running or other sports where the activity leads to strong repetitive rubbing. The resultant irritation and excoriation has been termed "jogger's nipple" because of the propensity in runners. Cold wind exposure further promotes bleeding, raw, severely painful nipples. This can be an issue in events such as cycling, crew, and multi-sport competitions. Prevention of exercise-induced nipple injury also includes a properly fitted sports bra. Additional interventions include coating the nipples with petroleum jelly or applying plastic bandages (eg. Bandaid) before activity, and avoiding cold and wind exposure with appropriate clothing.

Injuries from breast trauma include lacerations, contusions, and hematomas that may result in abscess formation, thrombophlebitis, and fat necrosis. Although it is beyond the scope of this chapter, physicians should be familiar with the management of these issues. It is of course also important to note that many exercise related injuries can mimic more serious illness. Although diagnoses such as intraductal papilloma and carcinoma are quite uncommon in the adolescent female, they should be considered if the diagnosis is not obvious.

Prevention and Return to Play

The Pre-Participation Examination Targeted for the Female Athlete

The purpose of the pre-participation physical exam is to detect medical conditions and musculoskeletal

problems that may lead to illness or injury. Theoretically, the examination is not intended as a substitute for the athlete's regular health maintenance visit, but in a great majority of cases, this is their only exposure to the health care system. The medical history is truly the most important part of the examination. In the female athlete the history should go beyond the usual past medical history, cardiovascular risk and previous injury questions. Because of the high risk of disordered eating and female athlete triad, a survey of the athlete's body image, nutritional habits and menstrual history, as mentioned previously, can be extremely important. In addition to the general physical exam, a comprehensive musculoskeletal assessment should be performed. Evaluate for and address muscle weakness, inflexibility, and other factors that may predispose to injury. Education about illness and injury risk factors is the most powerful tool the physician has in terms of preventing problems in the athletic adolescent female.

The pre-participation exam and outpatient office visits additionally provide appropriate settings for counseling on issues such as smoking, STD, and supplement use. It is a gross misconception that only male athletes are using ergogenic aids. Physicians caring for the young female athlete must be familiar with the use and side effects of these supplements so that they may provide appropriate counseling. Agents that have been used include anabolic steroids, creatine, amino acid supplements, stimulants, erythropoietin, and many others. A variety of studies suggest that 0.5 to 2.5% of high school females have tried anabolic steroids. (See Table 7 for a list of potential side effects) Stimulant use, (e.g. ephedra, caffeine), is likely underreported but, also is a major issue among female athletes, used both for weight control and performance enhancement. A "just say no" approach to ergogenic aid use has not proved effective, but awareness and education regarding risks may change current trends.

Table 7. Anabolic Steroid Side Effects (in Females)

Masculinization: Hirsutism, clitoromagaly, alopecia, voice deepening
Amenorrhea
Skin coarseness, Acne
Musculoskeletal effects: Acceleration of maturation, early epiphyseal closure / shortened ultimate adult height, increase in tendon injuries
Psychologic changes: Aggressiveness, irritability, depression
Hyperglycemia
Cholesterol changes (increased tot CHO, decreased HDL)
Gastric ulcers
Liver complications
Cardiovascular complications

Return to Activity After Injury or Illness

Timing and aggressiveness of return to full activity is based on multiple factors including type of injury/illness, degree of disability, interventions (eg surgery, injections, medications, etc), and compliance with rehabilitation. For certain injuries and illnesses, there are specific time guidelines for return to play that are considered standard of care. A full review of these issues is beyond the scope of this publication, but an example is returning to sport three weeks after mononucleosis infection (provided there is no splenic enlargement). The athlete should progress through the steps of rehabilitation as outlined above in "injury management." In general, she is able to return to activity gradually once the risk of worsening the injury is low and she is able to perform sport-specific functional activities without pain or problems.

Suggested Reading

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