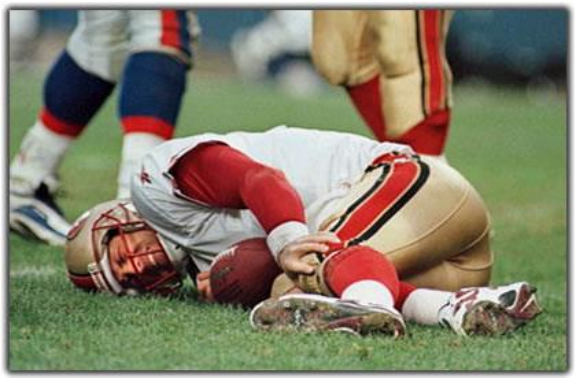
COMMON SPORTS INJURIES

DIAGNOSIS AND TREATMENT

UNIVERSITY OF UTAH
SCHOOL OF MEDICINE

COMMON SPORTS INJURIES DIAGNOSIS AND TREATMENT

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Chapter 1: CONCUSSIONS

What is a concussion?

A concussion, also known as a mild traumatic brain injury (mTBI), is a head injury that temporarily affects normal brain functioning. Symptoms may include loss of consciousness (LOC), memory loss, headaches, difficulty with thinking, concentration, balance, nausea, sleep disturbances mood changes. Any of these symptoms may begin immediately or appear days after the injury. Concussion should be suspected if a person indirectly or directly hits their head and experiences any of the symptoms. It is not unusual for symptoms to last 2 weeks in adults and 4 weeks in children.

The mechanism of injury involves either a direct blow to the head or forces elsewhere on the body that are transmitted to the head. This is believed to result in neuron dysfunction

Diagnostic imaging such as a CT scan or an MRI may also be required to rule out severe head injuries. Routine imaging is not required to diagnose concussion.

Treatment includes physical and cognitive rest for 1–2 days, with a gradual stepwise return to activities, school, and work. Prolonged periods of rest may slow recovery and result in greater depression and anxiety. Acetaminophen or NSAIDs may help with a headache. Physiotherapy may be useful for persistent balance problems and cognitive behavioral therapy may be useful for mood changes. Evidence to support the use of hyperbaric oxygen therapy is lacking.

Concussions are classified as mild traumatic brain injuries and are the most common type of TBIs. Males and young adults are most affected. Outcomes are generally good. Another concussion before the symptoms of a prior concussion have resolved is associated with worse outcomes. Repeated concussions may also increase the risk in later life of chronic traumatic encephalopathy (CTE), Parkinson's disease and depression.

Concussion's symptoms vary between people and include physical, cognitive, and emotional symptoms. Symptoms may appear immediately or be delayed. Up to one-third of people with concussion experience prolonged or persistent concussion symptoms, also known as post-concussion syndrome, which is defined as concussion symptoms lasting for 4-weeks or longer in children/adolescents and symptoms lasting for more than 14 days in an adult. The severity of the initial symptoms is the strongest predictor of recovery time in adults.

Physical

Headaches are the most common mTBI symptom. Others include dizziness, vomiting, nausea, lack of motor coordination difficulty balancing or other problems with movement or sensation. Visual symptoms include light sensitivity seeing bright lights, blurred or double vision. Tinnitus is also commonly reported. In one in about seventy concussions, concussive convulsions can occur. Concussive convulsions are thought to result from temporary loss or inhibition of motor function and are not

associated either with epilepsy or with more serious structural damage. They are not associated with any sequelae and have the same high rate of favorable outcomes as concussions without convulsions.

Cognitive and emotional

Cognitive symptoms include confusion, disorientation and difficulty focusing attention. Loss of consciousness may occur, but is not necessarily correlated with the severity of the concussion if it is brief. Post-traumatic amnesia, in which events following the injury cannot be recalled, is a hallmark of concussions. Confusion, another concussion hallmark, may be present immediately or may develop over several minutes. A person may repeat the same questions, be slow to respond to questions or directions, have a vacant stare, or have slurred or incoherent speech. Other mTBI symptoms include changes in sleeping patterns and difficulty with reasoning, concentrating, and performing everyday activities.

A concussion can result in changes in mood including crankiness, loss of interest in favorite activities or items, tearfulness, and displays of emotion that are inappropriate to the situation.

Diagnosis

Head trauma recipients are initially assessed to exclude a more severe emergency such as an intracranial hemorrhage. Indications that screening for more serious injury is needed include worsening of symptoms such as headaches, persistent vomiting. increasing disorientation or a deteriorating level of consciousness, seizures, and unequal pupil size.

Diagnosis is based on physical and neurological examination findings, duration of unconsciousness (usually less than 30 minutes) and post-traumatic amnesia (PTA; usually less than 24 hours), and the Glasgow Coma Scale. (mTBI sufferers have scores of 13 to 15). A CT scan or MRI is not required to diagnose concussion. Neuropsychological tests such as the SCAT5/child SCAT5 may be suggested measure cognitive function. Such tests may be administered hours, days, or weeks after the injury, or at different times to demonstrate any trend. Some athletes are also being tested pre-season (pre-season baseline testing) to provide a baseline for comparison in the event of an injury, though this may not reduce risk or affect return to play and baseline testing is not required or suggested for most adults.

Concussion may be under-diagnosed because of the lack of the highly noticeable signs and symptoms while athletes may minimize their injuries to remain in the competition. Direct impact to the head is not required for a concussion diagnosis, as other bodily impacts with a subsequent force transmission to the head are also causes. Diagnosis can be complex because concussion shares symptoms with other conditions. There are no fluid biomarkers (i.e., blood or urine tests) that are validated for diagnosing concussion.

Treatment

Those suspected concussion require a medical assessment to confirm the diagnosis of concussion and rule out more serious head injuries. After life-threatening head injuries, injuries to the cervical spine, and neurological conditions are ruled out, exclusion of neck or head injury, observation should be continued for several hours. If repeated vomiting, worsening headache, dizziness, seizure activity, excessive drowsiness, double vision, slurred speech, unsteady walk, or weakness or numbness in arms or legs, or signs of basilar skull fracture develop, immediate assessment in an emergency department is needed. Observation to monitor for worsening condition is an important part of treatment. People may be released after assessment from their primary care medical clinic, hospital, or emergency room to the care of a trusted person with instructions to return if they display worsening symptoms or those that might indicate an emergent condition such as change in consciousness, convulsions, severe headache, extremity weakness, vomiting, new bleeding or deafness in either or both ears. Education about symptoms, their management, and their normal time course, may lead to an improved outcome.

Rest and return to physical and cognitive activity

Physical and cognitive rest is recommended for the first 24–48 hours following a concussion after which injured persons should gradually start gentle low-risk physical and cognitive activities that do not make current symptoms worse or bring on new symptoms. Any activity for which there is a risk of contact, falling, or bumping the head should be avoided. Low-risk activities can be started even while a person has symptoms if the activity does not worsen existing symptoms or bring on new concussion symptoms. Resting for longer than 24–48 hours follow concussion has been shown to be associated with longer recovery.

Return-to-sport

For persons participating in athletics, it is suggested that participants progress through a series of graded steps. These steps include:

- Immediately after injury: 24-48 hours (maximum) of relative physical and cognitive rest.
- Stage 1: Gentle daily activities such as walking in the house, gentle housework, and light school work that do not make symptoms worse. No sports activities.
- Stage 2: Light aerobic activity such as walking or stationary cycling
- Stage 3: Sport-specific activities such as running drills and skating drills
- Stage 4: Non-contact training drills (exercise, coordination, and cognitive load)
- Stage 5: Full-contact practice (requires medical clearance)
- Stage 6: Return to full-contact sport or high-risk activities (requires medical clearance)

At each step, the person should not have worsening or new symptoms for at least 24 hours before progressing to the next. If symptoms worsen or new symptoms begin, athletes should drop back to the previous level for at least another 24 hours.

Athletes are typically followed closely by team athletic trainers during this period but others may not have access to this level of health care and may be sent home with minimal monitoring.

Repeat concussion

For unknown reasons, having had one concussion significantly increases a person's risk of having another. Having previously sustained a sports concussion has been found to be a strong factor increasing the likelihood of a concussion in the future. People who have had a concussion seem more susceptible to another one, particularly if the new injury occurs before symptoms from the previous concussion have completely gone away. Repeated concussions may increase a person's risk in later life for dementia, Parkinson's disease, and depression.

Post-concussion syndrome

In post-concussion syndrome, symptoms do not resolve for weeks, months, or years after a concussion, and may occasionally be permanent. About 10% to 20% of people have post-concussion syndrome for more than a month. Symptoms may include headaches, dizziness, fatigue, anxiety, memory and attention problems, sleep problems, and irritability. Rest, a previously recommended recovery technique, has limited effectiveness. A recommended treatment in both patients with symptoms beyond 4 weeks involves an active rehabilitation program with reintroduction of non-contact aerobic activity. Progressive physical exercise has been shown to reduce long-term post-concussive symptoms. Symptoms usually go away on their own within months but may last for years. The question of whether the syndrome is due to structural damage or other factors such as psychological ones, or a combination of these, has long been the subject of debate.

Chapter 2: COMMON SHOULDER INJURIES

The evaluation of shoulder injuries in athletes is a complex process that relies on accurate diagnosis before proper management can be effective. It is one of the most difficult areas of the body to assess given its intricate makeup and structure and the demands placed on it in athletics. Injuries to muscles, ligaments, and tendons are generally the problem, rather that issues with bones. Shoulder injuries are very common in football, along with other sports to an extent. Shoulder injuries in soccer and lacrosse don't occur at the same rate as contact sports such as football, but they do occur. Athletes often overlook shoulder pain, while it is very importance to deal with the issue before things progress. A careful history and thorough physical examination are critical before a plan of action can be outlined.

Shoulder injuries can be broken down into two basic types of injuries: **acute** and **chronic**. It is essential that the examiner determine whether the injury was of sudden onset or a slow progression of symptoms over a long period of time. Determining this history is the first step in determining the injury. If the injury was of sudden onset, then a detailed history pertaining to the exact mechanism of injury should be obtained from the athlete to determine if outside resistive forces, direct trauma, or other factors could have caused the injury. If the injury has been painful for several days or weeks, then a thorough history should be reviewed for any factors that could cause this injury. Physical examination will confirm or change what the diagnosis suggested by the history.

Anatomy

The shoulder is a complex ball and socket joint made up of 5 articulations: glenohumeral (GH), scapulothoracic (ST), sternoclavicular (SC), acromioclavicular (AC), and coracoclavicular (CC). The arm is able to move and perform as it does through a coordinated movement of all of these joints.

The shoulder is comprised of three bones: the scapula, humerus, and clavicle. They are able to provide an extraordinary range of movements--but all at an increased risk for injury. The glenohumeral joint is stabilized by the glenoid labrum, a fibro-cartilaginous ring that gives a little more depth to the shallow glenoid fossa. The capsule surrounds this entire structure and is further stabilized by the musculotendinous bundle of rotator cuff muscles. The acromion process comes up over the top and forms the subacromial space. The narrow subacromial arch is further shortened by the coracoacromial and coracohumeral ligaments and is the primary area of shoulder impingement injuries.

Taking a History

Paying close attention to the specific details surrounding the injury is the first critical step in accurately assessing any athletic injury. For acute injuries, details should be directed towards the mechanics of the injury and what might have been the causing factor of the injury.

What happened? Diagnosing the injury

- Obtain specific details.
- *What position was your arm in at the time of injury?*
- Forces are transferred to the shoulder following a fall or hit to an outstretched arm.
- *Did you hear anything at the time?*
- Noises such as hearing a "tear" or a "rip" are usually indicative of a serious injury.
- *Was there immediate pain and did you discontinue activity because of it?*
- Injuries that the athlete was able to continue to participate with are not typically serious although the possibility of there being underlying pathology should never be overlooked.

Once the mechanism has been isolated or diagnosed, whether it is an acute or chronic injury, then the examiner can begin to get even more specific details. *Have you ever injured this shoulder before and if so what did you do for it then?*

- Previous history of injury will always give clues to current condition.
- *What kind of pain are you having?*
- Sharp, dull, throbbing, aching, burning.

- *Does your pain radiate anywhere?*
- Down the arm is usually indicative of neck or shoulder injury, up into the neck is a sign of cervical and/or soft tissue strain, and anything into the chest or abdomen should be closely evaluated for intrathoracic involvement.
- *Does movement in your neck bring on or increase pain in your shoulders?*
- Question cervical radiculopathy or neuropathy.
- *Do you have pain at rest and does it keep you awake at night?*
- Resting pain is a sign of either an acute inflammatory response or could also be indicative of some neurological pathology.

Inspecting the Shoulder

A careful examination of the shoulder joint begins with a visual inspection of the athlete's neck, shoulders, scapulae, and upper thorax. A systematic approach should be taken by starting at the neck and working down both shoulders looking for asymmetry, and also looking for the attitude of the shoulder and how they are holding it, deformity, atrophy, or any obvious scars or marks are looked for.

When inspecting the shoulder anteriorly, an obvious asymmetry at the AC joint with the injured side being more prominent is indicative of an AC separation. Discoloration and ecchymosis (bruising) may be apparent from a rotator cuff injury, fracture, significant shoulder contusion ('shoulder pointer'), or biceps rupture. Significant atrophy of the deltoid muscle or loss of the lateral muscle contour could indicate a glenohumeral dislocation or a neurovascular lesion. An indentation of the upper biceps region and/or a bunching up of the biceps tendon with elbow flexion signifies a rupture of the biceps tendon. Posteriorly, if the scapulae appear uneven, then it could be a sign of scoliosis or poor muscle balance. Winging of the scapulae usually means that there is weakness of the serratus anterior muscle. However, if it is unilateral, then it could be a sign of an injury to the long thoracic nerve. Wasting of the infraspinatus fossa below the scapular spine is a hallmark of rotator cuff injury. Laterally, if they have an obvious forward head and rounded shoulders posture than they could have an impingement syndrome at the AC joint.

Palpating the Shoulder

Standing from behind, the athlete is palpated for areas of tenderness, obvious deformities and temperature changes. Observing palpations in a football player are often difficult because they are wearing pads, and proper precaution must be taken. Beginning anteriorly and moving laterally (outward):

- the sternoclavicular joint is palpated for signs of possible dislocation
- the shaft of the clavicle for signs of possible fracture
- the AC joint for partial or total separation. This is determined by increased mobility on the distal clavicle
- the pectoralis muscles for deformity or increased tone (indicating spasm or trigger points)

- the biceps tendon/bicipital groove, which is best palpated with the arm externally rotated to about 60 degrees with the thumb on the anterior shoulder (indicating tendinitis)
- Supraspinatus muscle, which is best palpated with the patient standing with their hands on their hips and the examiner feeling just off the lateral edge of the acromion (indicating tendinitis or tear)
- scapular spine and infraspinatus fossa for signs of obvious wasting (indicating RC tear or possible neurological involvement) or tenderness (indicating infraspinatus tendinitis, excessive swelling, or fracture of the scapular spine)
- vertebral border of the scapula for increased tenderness and/or spasm (indicating scapula- thoracic bursitis or trigger points)

Assessing both Active and Passive Motion

Active movements (AROM) are assessed first when checking range of motion and are usually done in such a way that the painful movements are performed last. The active movements that are to be evaluated with their corresponding normal ranges are:

- Forward flexion (170 - 180 degrees)
- External rotation (80 - 90 degrees)
- Abduction (165 - 180 degrees)
- Extension (50 - 60 degrees)
- Internal rotation (60 - 100 degrees)
- Adduction (50 - 75 degrees)
- Horizontal adduction/abduction (arm at shoulder height, across the front of the body)

Some other important things to note when assessing AROM are *painful arc*, which is tested while the patient abducts the arm. If pain is elicited between about 45 and 120 degrees but not at the beginning or end ranges, then a positive painful arc is present. It happens as a result of impinging tissue on the acromial arch and the coracoacromial ligament and is usually indicative of subacromial bursitis, tendinitis of the rotator cuff, or impingement syndrome

Passive range of motion (PROM) is assessed with the patient supine and checking all ranges for pain (making sure the patient is as relaxed as able), restrictions (noting the end-feel of the movement), or excessive motion (hypermobility can be a sign of glenohumeral instability).

A couple of general guidelines are if there is limited AROM and PROM, then one should suspect a frozen shoulder, fracture or chronic bursitis. Limited AROM but full PROM is indicative of a RC tear. If there is full AROM and PROM but one resisted movement hurts, it is a sign of tendinitis.

Strength Testing

Resisted movement tests are performed with the patient lying supine. By carefully noting which movements cause pain, the examiner can begin to determine which muscles are involved. The movements to be tested isometrically are the same as those tested for AROM with resisted elbow flexion and extension added. Carefully record which motions are painful, guarded and/or weak. A general guideline for patterns of pain and weakness are as follows:

-strong and painful: tendinitis
-weak and painful: serious
-weak and painless: RC tear or nerve root
-all strong and painful: hysteria
-all strong and painless: normal
-pain with repetition: vascular

Upon completion of the initial evaluation, the examiner should at this time have a pretty good idea of which structures are involved. At this point, there are special tests that will help to confirm or refute the other findings. It is also important that only the only the relevant special tests be performed as there are too many to perform routinely.

Tests:

Supraspinatus Test/Centinela Supraspinous Test--the patient's arms are brought into 90 degrees of forward flexion and then into 30 degrees of horizontal abduction, the arms are then internally rotated so the thumbs are pointed downward. The evaluator applies downward pressure while the athlete resists and a positive response is if there is pain and/or weakness, indicating supraspinatus involvement.

Drop Arm Test--also a test for rotator cuff tears. The examiner abducts the arm to about 90 degrees and then has the patient slowly lower the arm to their side. A positive test is if the patient is unable to lower arm or is able to do so with considerable pain. Another possible result is if they are unable to actively lower the arm but they are able to hold it at shoulder height, the practitioner can give a light tap on the wrist and the arm will fall.

Speed's Test/Biceps Test--The examiner resists forward flexion with the arm in supination and the elbow completely extended. Pain and/or weakness in the bicipital groove indicates a biceps strain or bicipital tendinitis.

Test for a Subluxing Biceps Tendon and Bicipital Tendinitis--the patient lies supine with the arm in extension off the end of the table and the forearm in pronation, and slowly extend the arm. If this pain is in the bicipital groove, then this is a sign of tendinitis. Now bring the arm slightly out of extension and then externally rotate the arm with the examiner's thumb on the bicipital groove. A positive test is if the biceps tendon pops out of the groove indicating a tear of the transverse humeral ligament.

Impingement Sign--the arm is forward flexed to 90 degrees passively, the proximal humerus is internally rotated with the elbow bent and a positive sign is if the patient complains of reproducible pain at the subacromial space. An alternative method is to forward flex the arm to its overhead end-range and then forcibly put over pressure to the arm trying to "jam" the greater tuberosity into the acromion.

Cross Adduction Test--the arm is brought to 90 degrees of forward flexion and then passively brought across the front of the body. A positive test is if pain is elicited at the anterior shoulder, indicating a possible subcoracoid bursitis or labral/capsular tear.

Apprehension Test--the patient lies supine and the examiner brings the arm into 90 degrees of abduction, elbow flexion and external rotation. The arm is externally rotated while the examiner watches the reaction of the patient. A positive test result is achieved if the patient has a look of apprehension or alarm on their face and state that they feel that the shoulder will dislocate if it is pushed any further. The examiner is also trying to assess the feel of the mobility of the GH joint for any obvious laxity (looseness) compared with the other side. Care must be taken to perform this test slowly as it can sublux the humeral head in very lax patients.

Relocation Test--immediately following the Apprehension Test and any positive results, if an anterior force is applied on the posterior aspect of the humeral head, this translation increases the pain. If a posterior force is applied in the same testing position and the patient's symptoms are reduced, this suggests that the pain is as a result of the head pressing anterior on the static stabilizers often found in subluxation.

Load and Shift Test--the patient is supine and the examiner grasps the proximal humeral head and a gentle load is applied anteriorly, posteriorly, and inferiorly to assess the amount of joint play in the GH joint. A positive test is if the humeral head excessively translates compared to the contralateral side--especially if it feels as if the head subluxes over the rim of the labrum. This is an indicator of a uni- or multi-directional instability. Occasionally, a click might be elicited with testing and could be sign of a torn labrum.

In conclusion, a few basic tips that an examiner can provide to their patients for some of the more common diagnoses are:

- acute injuries should be iced regularly for 15 minutes at a time for the first three days

- people with positive impingement signs should be instructed on postural exercises to eliminate a typically forward head/rounded shoulders posture
- positive findings for frozen shoulder should be referred to a physical therapist (PT) or the athletic trainer (ATC) working with their team for manual mobilization techniques and PROM exercises
- acute shoulder dislocations and any question of a torn RC or labrum should be referred to an orthopaedic surgeon for further workup; but should be instructed on elbow flexion and extension exercises to decrease stiffness, gripping exercises for the wrist and forearm, pendulum exercises with the involved arm dangling like a pendulum to decrease GH stiffness
- uni- or multi-directional instabilities should also be referred to a sports rehab specialist so they can be instructed on a shoulder stabilization program
- any signs, symptoms or suspicion of a fracture should be immediately immobilized in a sling and referred to a physician
- Developing a careful, systematic approach to shoulder examinations helps to not only make a examiner more efficient, but also strengthens assessment skills. This will also translate to your patients in improved trust and confidence in your findings.

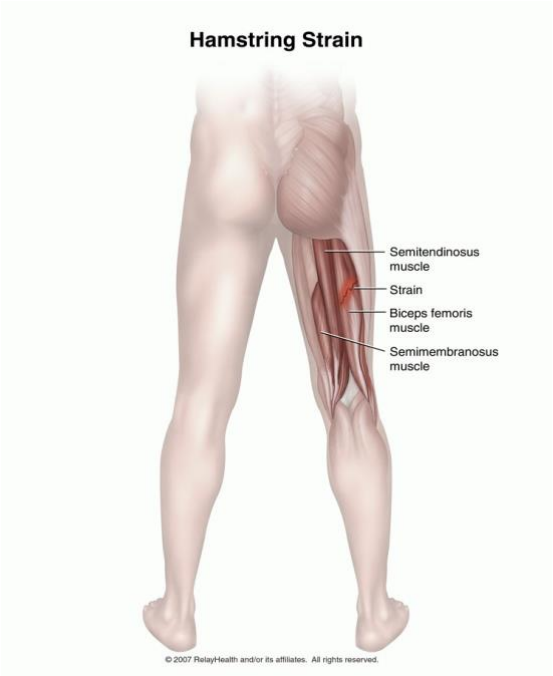
Chapter 2 Review Questions

1. Explain the two basic categories for shoulder injuries and know the difference between them.
2. What are the 5 joints that make up the shoulder? And explain what the purpose of these joints having coordinated movement.
3. Explain what is being tested for in a drop arm test and what characterizes a positive test.
4. When examining a shoulder, the examiner can use palpation in order to discover what three main problems? And explain how to go about palpating a patient's shoulder
5. During a football game a player falls on his shoulder and is in obvious discomfort. What is the first step that should be taken in determining the injury

Chapter 3: HAMSTRING INJURIES

Three muscles in the back of the thigh are collectively called the hamstrings:

1. Biceps femoris
2. Semitendinosus
3. Semimembranosus



The two general attachment sites for the hamstrings are the:

1. bony prominence felt under each "cheek" when sitting (ischeal tuberosity)
2. the back of the knee.

Contraction of the hamstring causes:

1. the knee to bend
2. the thigh to move backwards relative the trunk, although these actions usually do not occur simultaneously.

The hamstrings play a vital role in walking, running, jumping, and controlling movements of the trunk. Hamstring strength is very important in soccer, football, lacrosse and other field sports. Athletes rely on hamstring strength to kick a ball, sprint, and jump. This reliance on the hamstring also makes it very likely to be injured.

A hamstring strain is an excessive stretch or tearing of muscle fibers and related tissues. Hamstring strains can occur at one of the attachment sites or at any point along the length of the muscle (see figure above). They are classified as 1st, 2nd, or 3rd degree depending on the severity.

First Degree:

Excessive stretching or minor tearing of a few muscle fibers. The pain can often be localized with one finger. Some stiffness and weakness will also be present. If exercise is attempted, the pain and stiffness may decrease during the activity, but return after, often with much greater intensity. These are very common and often played through by athletes.

Second Degree:

Moderate tearing of muscle fibers with pain generally covering a larger area than the 1st degree strain. Stiffness and weakness will be felt and the painful area may appear black and blue due to bleeding within the injured muscle. Significant limping may also occur when walking. Athletes playing sports such as soccer lacrosse would have a significant amount of trouble participating.

Third Degree:

A complete tear of the muscle. Widespread bruising will be present and a "balling up" of the muscle may be seen or felt with you hand. 3rd degree strains are a rare occurrence, but very severe and put any athlete on the sideline.

A hamstring strain can occur during an isolated athletic activity (acute) or result from persistent repetitive stress (chronic). Often an acute strain occurs as a result of a chronic condition, which has rendered the muscle weak and vulnerable. An example of this is the lacrosse player who, rather than miss a game to allow adequate healing of a minor recurrent strain, has "babied" the injury throughout the season until sprinting one day causes further injury.

As in the case of a baseball or softball player, hamstring strains often occur while sprinting. They also can occur during jumping and other activities where quick starts and stops are required. High risk sports for hamstring strains are: soccer, football, baseball, lacrosse, basketball, and many track and field events. Runners are especially susceptible to chronic hamstring strains due to the repetitive nature of the sport.

TREATMENT

First Degree:

Like most recent athletic injuries, the RICE (Rest, Ice, Compress, and Elevate) method of treatment, in the early stages, is most beneficial. Rest from the activity that caused the muscle strain allows for healing to occur. Immediately following the muscle strain, ice should be applied over the painful area for 10-15 min. Periodic icing (2-3 times per day) will help to control swelling and reduce pain. Heat should not be applied to the area during the first 3-4 days since this may increase swelling and bleeding within the muscle. An elastic wrap or compressive stocking may be applied to the area to assist with swelling control. If the compressive device causes increased discomfort or "pins and needles" in any part of your leg, it’s probably too tight. Lying down periodically with your leg elevated allows gravity to assist with

your effort to control the swelling. Using compression while participating is also often done in sports that require a lot of running.

Though some experts believe early stretching to be valuable, caution should be taken early on to avoid aggressive stretching (stretching beyond the point of mild discomfort) which may hinder healing. Gentle stretching and light resistive exercise during the first few days, will help to properly align the healing muscle tissue. Following exercise, the application of ice while maintaining a stretch, not only helps to control swelling, but also helps the muscle to maintain flexibility. Progress exercises, using pain during or after activity as your guide, to running, sprinting, jumping, and full athletic competition. When beginning more advanced activities such as running, avoid quick starts and stops or other ballistic movements which can cause re-injury Remember to properly warm-up and stretch before participating in athletics, and then conclude with a good stretch The most effective stretching occurs when the muscle is warm from exercise and when the stretch is held for long duration.

Chronic hamstring strains are usually first degree in nature and are often associated with improper warm-up or overuse. If proper warm-up and stretching techniques are being followed, resting the strained muscle by decreasing the intensity, duration, or frequency of the activity may be sufficient to resolve the problem. If the strain persists, a thorough evaluation by a trained professional is advised. Chronic hamstring injuries may occur in a wide variety of sports and are common in field sports and running.

Second Degree:

For most second-degree hamstring strains the treatment is the same as with first degree strains, however the speed of progression must be slowed and recovery will be longer (possibly 2-3 weeks). You may wish to seek professional care for a second degree strain where specialized techniques are used to enhance healing and recovery.

Third Degree:

Seek immediate medical attention if suspected. Crutches will most likely be prescribed and the RICE treatment, as previously described, will be necessary for 4-6 weeks.

Chapter 3 Review Questions

1. What are the 3 muscles that make up the hamstring? Explain what these muscles are able to achieve while contracting.
2. What occurs when the hamstring muscles are strained and what are the three classifications for hamstring strains?
3. What are the characteristics of a third degree hamstring strain and what separates this strain from a second degree strain?

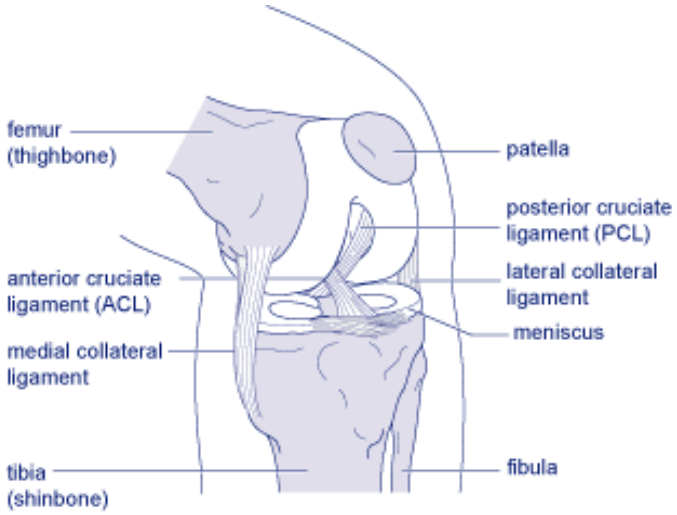
4. In the case of a first degree hamstring strain, why does one need to be very cautious when stretching before the muscle is completely healed.
5. If a patient comes to you complaining of soreness and tenderness in the back of their knee is there any possibility of it being a hamstring injury? Why or why not?

Chapter 4: KNEE INJURIES

A sprained knee, along with many other more severe injuries, is one of the most common sporting injuries. It happens when the knee receives an impact or is moved beyond its normal range of movement. This can occur as a result of a fall, landing awkwardly, or even just from changing direction. Sports that combine running and stopping with quick changes of direction such as soccer, football, rugby, lacrosse and basketball cause plenty of knee injuries. These injuries are very common and can be very serious.

Soft tissue injuries

The bones of the knee can be damaged in sports and other accidents, but it is more common for soft tissues such as ligaments to be injured.



The left knee

The knee

In activities such as walking, climbing stairs or running, the knees carry nearly the whole weight of the body. It is a tough joint that acts like a hinge between the thighbone (the femur) and the shinbone (tibia). But as well as bending and straightening, the knee joint allows rotation and pivoting. This makes it one of the most complex joints in the body, which as a result makes it susceptible to many different injuries.

To allow these movements, the bones that meet in the knee joint are supported by several other structures - see diagram, above. The most important of these are:

Four knee ligaments - strong cord-like tissues that connect the bones of the upper (femur) and lower legs (fibula, tibia). Injuries to these ligaments are very common in sports such as soccer and football.

Articular cartilage - a smooth coating for the ends of the bones. Allow bones to move without friction against each other.

Menisci - two crescent-shaped discs of shock-absorbing cartilage that sit between the thigh and shin bones. Meniscus injuries are often accompanied with ligament damage.

Tendons - these are tough bands that join the muscles of the upper and lower leg, and also hold the patella (knee cap) in place.

In an injury to the knee, one or more of these structures can be damaged. The more common of these include spraining or tearing one or more ligaments, tearing the meniscus or straining a tendon or muscle.

Typical symptoms include pain, swelling or bruising. For more severe injuries, the joint can become stiff, unstable or "locked". A telling symptom of a ligament injury is a “popping” sound. Symptoms may vary by patient.

Knee pain and restricted movement can develop without there being a specific incident, this makes them harder to diagnose. Causes include over-use injuries and osteoarthritis. These injuries are chronic, and can be common in sports that require a lot of jumping and running such as soccer, football, and lacrosse. In soccer, chronic knee injuries are a very common occurrence.

Knee ligament injuries

Ligaments connect one bone to another within a joint and help to provide stability and flexibility. There are four main ligaments in the knee. Injury to each one has slightly different symptoms and treatment. Injury to ligaments occurs in regular occurrence in active sports such as soccer. It is possible and not unlikely to damage more than one ligament in the same incident.

The **medial collateral ligament** is located on the inside of the knee and is taut when the leg is straightened. It is a strong ligament but can be sprained or completely torn (ruptured) when the straightened leg is twisted at the same time as being knocked sideward. This can be during a contact sport, as with a football tackle, or without contact, as can happen in soccer by planting and twisting, or hyperextending the knee.

The injured knee is painful and swollen, especially on the medial (inner) side. By examining the knee and seeing how much the lower leg can be moved outwards, while the upper leg is held still, doctors can usually establish how badly the ligament is sprained. Grade I (a sprain) and grade II (partial tear) injuries of the ligament, are more painful than a complete (grade III) tear. Many grade II or I sprains will heal by themselves. A grade III tear usually requires surgery.

The **anterior cruciate ligament (ACL)** joins the back of the inside of the thighbone to the outside front of the shinbone. Cruciate means in the form of a cross. The ACL is so called because it crosses the posterior cruciate ligament (PCL).

The ACL is about half the strength of the medial collateral ligament and is the most commonly injured ligament in sport. In the United States alone, there are over 70,000 ACL injuries per year. Players of football, soccer, lacrosse and other sports that involve running, jumping and landing, are prone to ACL tears or ruptures. The occurrence of ACL injuries in female soccer players has shown to be higher than in any other sport, but everyone is at risk.

When the ACL is completely ruptured, it is common to hear and feel a distinct popping sound, such as soccer player might hear when planting and having the knee hyperextended. The athlete may also feel something snap inside the knee. If the knee appears loose, it is usually a sign of an ACL injury. Other symptoms include:

- pain and tenderness
- almost immediate swelling
- an unstable knee, making it difficult to walk
- the knee locking during movement

The test for an ACL injury is done by pulling the lower leg forward while holding the thigh still.

Treatment depends on how badly the knee is affected by the loss of the ligament and whether this prevents the athlete from doing sport. If you do not ask a lot of the knee, the knee may not need to have it repaired. Others who are more active may need a reconstruction operation, which usually involves taking a graft of tendon (usually from the kneecap) to replace the lost ligament. Intensive physiotherapy to strengthen the thigh muscles (quadriceps) is necessary as part of a program of rehabilitation. The rehabilitation process can take up to 8 months before an athlete can fully participate in a sport like lacrosse that requires the knee at full strength.

The **posterior cruciate ligament (PCL)** joins the inside of the end of the thighbone to the back (posterior) of the shinbone. With the ACL, it forms a cross-shape. Also like the ACL, it helps to stabilize the front to back knee movements. The PCL is stronger than the ACL and therefore less prone to injury. PCL injuries are uncommon and often occur when the other three ligaments are torn as well. The symptoms of a sprain may be milder than for an ACL injury, with no popping sound.

For a suspected PCL injury, have the athlete lay on his/her back then raise the legs so that the thighs point straight up, with the knees bent at right angles. If the lower leg sags toward the floor, the PCL is probably torn. Other symptoms of a PCL injury are similar to those in ACL injuries. Less severe injuries can be treated by strengthening the thigh muscles. Surgery is often recommended, especially for younger patients and those wanting to return to a high activity level. The rehabilitation process is much less extensive compared to an athlete with an ACL injury.

The **lateral collateral ligament (LCL)** is on the outside of the knee. It is rarely injured on its own but may need to be surgically repaired at the same time as other ligaments. A tear of all 4 ligaments isn't uncommon. Damage to this ligament causes pain and swelling on the outside edge of the knee.

Diagnosing ligament injuries

In addition to the examinations mentioned above, the doctor may also press gently over the kneecap to feel for fluid in the joint, especially if the injured knee is not severely swollen. Other tests to help with diagnosis may include an X-ray (to rule out a broken bone) and MRI scan. Ultimately, an MRI scan is necessary in finding a ligament injury because other examinations vary with patients and are often hard to give a conclusive diagnosis.

Other soft tissue injuries

A sport such as football or soccer that involves quickly twisting the upper leg while the foot is firmly planted on the floor can result in a tear to the meniscus. The force that injures ligaments often also leaves the patient with damage to the meniscus. Older people, in whom the meniscus are more likely to be worn down can suffer a

tear from even a very minor injury. Treatment depends on the degree and exact location of the injury. Surgery to repair or remove the torn meniscus may be appropriate for some people, especially those who plan on returning to highly active activity. Others may be advised to follow a program of muscle strengthening.

The tendon that connects the kneecap to the thigh muscle (patellar tendon) can be torn if the knee is bent too far back. A popping or tearing sound may occur. There is also pain, swelling and weakness of the joint. With the knee protected in a knee brace, a partial tear of the tendon can heal within several weeks. A complete tear may require surgery.

First aid

- The first aid treatment for knee injuries is the same whichever ligament is injured.

Treatment and rehabilitation

If surgery is not required, physiotherapy, sometimes including ultrasound treatment, can help speed recovery. A severe knee ligament injury can lead to long-term weakness in the joint and may increase the chance of hurting the ligament again, even during less strenuous activity. A structured program of rehabilitation, supervised by a physiotherapist or doctor specializing in sports medicine is likely to best ensure the quickest and most complete recovery. Re-injury, especially in those trying to return to sports, to those with a severe ligament injury is common because patients don't give it enough time to reach complete recovery. Patience is the most important factor when looking to return from one of these injuries.

Prevention

To reduce the risk of knee ligament injuries:

- Exercise regularly. If the patient has not been active for a while, gradually increase the intensity of the exercise, with progressively harder training.

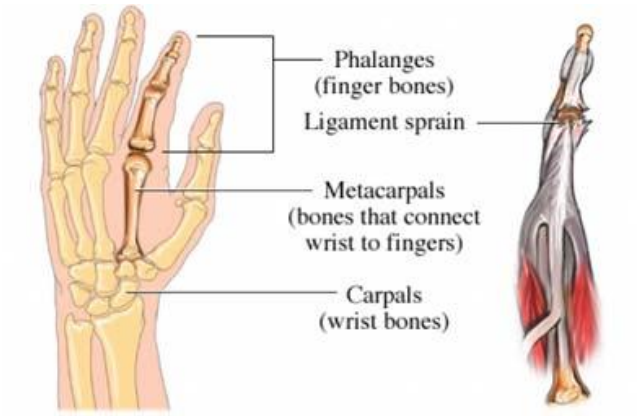
Warm up properly before making major demands on the body. Stretching the main joints follows warm-ups. After vigorous activity, a few minutes should be spent doing gentle exercise, followed by another stretching session. The nature of this injury makes it hard to prevent from happening in sports that require a lot of cutting and jumping. These dreadful injuries can often happen during a normal movement than the athlete has performed hundreds of times, such as a soccer player planting while kicking the ball.

Chapter 4 Review Questions

1. What are the three bones that make up the knee joint? Explain where each is specifically located within the leg.
2. What makes a chronic knee injury more difficult to diagnose and what can be two causes of chronic knee injuries?
3. What ligament is most commonly injured and what are the symptoms that accompany an injury to this ligament?
4. Explain why a patient with a severe knee injury should receive an MRI, and an X-ray. Why are both necessary?
5. An athlete says he heard his knee "pop" when he fell to the ground during football practice. What injury has likely occurred and what other signs and symptoms should be present?

Chapter 5: FINGER SPRAINS

Finger sprains are injuries that cause a stretching of the ligaments of the fingers or thumb. The most common cause of a finger sprain is a fall onto your hand. Often the finger bends unusually causing the ligament injury and subsequent pain. Spraining a finger can be common in any sport, including basketball and football, which both place a lot of stress on the hand and fingers. An example is a football player spraining his finger when trying to catch a ball.



What are the symptoms of a finger sprain?

Symptoms of a finger sprain include pain, swelling, and tenderness of the finger. An x-ray should be performed to ensure that there is no fracture of the bones.

How is a finger sprain treated?

Finger sprains are often splinted or buddy taped for a short period of time; this is done to stabilize the finger. So long as there was no fracture or dislocation, most finger sprains should be allowed to move within about a week. Splinting the sprained finger during sports can help protect the injury, but unnecessarily splinting the finger cause it to stiffen up.

Other treatments for a finger sprain include:

- Ice the injured finger
- Elevate if there is swelling
- Take an anti-inflammatory medicine
- Gently move the finger to prevent stiffening

Thumb sprains may require a longer period of immobilization, especially if there is concern that a ligament was torn. One injury in particular, the so-called "Gamekeeper's thumb," requires immobilization, and occasionally surgery. This particular injury is important because chronically injured ligaments at this joint affect our ability to pinch.

Finger Dislocations

A finger dislocation is a different type of injury, and more severe. When a joint is dislocated, the normal alignment of the finger is altered, and the joint must be put back into place.

When the joint is dislocated, the ligaments and joint capsule surrounding the injured joint are torn. Sometimes, these ligaments do not heal adequately and surgery is occasionally needed to repair the injured structures. That said, most finger dislocations can be treated with a simple splint. Once the joint has been put back into position, the finger is splinted to allow the ligaments and joint capsule to heal. Treatment principles of a dislocated finger are similar to those for a sprained finger.

Chapter 5 Review Questions

1. What are common symptoms of a finger sprain? What is being injured?
2. Why is finger splinting important and what is the splints function?
3. What factors make a finger dislocation more severe?
4. In order to return to action quicker, what should a patient do to ensure a quick recovery from a finger sprain?

Chapter 6: ANKLE INJURIES

What is an ankle sprain or sprained ankle?
An ankle sprain is the most common injury to the ankle and the long-term consequences of an ankle sprain is a common cause of chronic ankle pain. The most common type is the inversion ankle sprain, in which the ankle rolls over on the outside.

An ankle sprain is the stretching and tearing of ligaments - in the sprained ankle the most common damage is done to the talo-fibula ligament (if the ankle sprain is worse, the calcaneo-fibula ligament can also be damaged) - sometimes the tendons also get damaged.

Sprained ankle causes:

Anything that makes the ankle 'tip over' increases the chance of an ankle sprain – this occurs in sport such as football, soccer, and rugby at very high rates (eg. jumping and landing on someone else's foot), walking on uneven surface, twisting motions etc.

A number of factors predispose to ankle sprains:

- poor rehabilitation of a previous sprained ankle
- poor proprioception
- some feet are very easy to 'tip over' - this is common in those who frequently 'roll the ankle
- weak muscles (they are just not strong enough to prevent the sprain occurring)

Ankle sprain types:

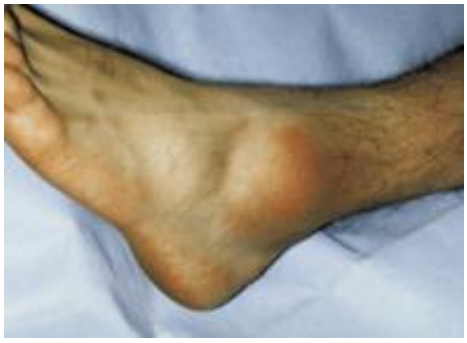
The sprained ankle is often classified as to how severe it is:

First degree ankle sprain:
* Some stretching or mild tearing of the ligament.
* Little or no functional loss - the joint can still function and bear some weight (..but hurts!!!).
* Mild pain
* Some swelling
* Some joint stiffness.

Second degree ankle sprain:
* Some more severe tearing of the ligaments
* Moderate instability of the joint
* Moderate to severe pain – weight bearing is very painful
* Swelling and stiffness

Third degree ankle sprain:
* Total rupture of a ligament - there is a loss of motion
* Gross instability of the joint - joint function is lost
* Severe pain initially followed by no pain
* Severe swelling

Sprained ankle treatment



If the ankle sprain is a 2nd degree sprain, then in a more effective means of immobilizing the ankle (splints) may be needed. Anti-inflammatory medication may also be used to help.

If the ankle sprain is a 3rd degree sprain, cast immobilization is needed for at least 2-3 weeks. Surgery to repair the ruptured ligament is not often needed.

Physical therapy modalities (such as ultrasound) and manual therapy modalities (such as friction massage) are often used when the acute phase is over. These are done to reduce swelling.

As soon as treatment is instigated, consideration must be given to adequate rehabilitation:

- exercises to increase proprioception
- ankle braces and strapping to facilitate activity
- muscle strengthening and flexibility exercises
- gradual return to any sporting activities
- maintain fitness by doing alternative activities

Exercises for sprained ankle rehabilitation

Exercises after the first 48 hours (time must be given to reduce swelling) play a major role in the in the rehabilitation of the sprained ankle and the prevention of ankle sprains.

Range of motion exercises

Initially, start by using a towel to gently pull the foot towards you. Repeat this several times a day, Later use calf muscle stretches against the wall.

Balance

Initially, start by balancing on one foot - hold for as long as possible - repeat several times a day. Later a 'wobble' board can be used.

Strengthening

Initially start by pushing the foot outward against a wall. Hold for 3 seconds - repeat 20 times, several times a day. Later use an elastic band that is tied to a heavy object and move the foot outward against this.

What causes long term pain after ankle sprains

The most common cause for long-term pain after an ankle sprain is poor rehabilitation of a previous ankle sprain. All causes of chronic pain after an ankle sprain should be evaluation by a health professional.

The common causes are of chronic ankle pain are:

- poor rehabilitation
- a fracture that was not initially diagnosed
- congenital abnormality
- post traumatic arthritis
- osteochondritis dissecans (loose bit of bone in the joint)
- sinus tarsi syndrome
- syndesmotic ligament injury
- functional instability (a feeling of 'giving way')

The list is complicated and diagnosis of what is causing the chronic pain after the ankle sprain is not easy.

Prevention of the sprained ankle

Several things can be done to prevent an ankle sprain, especially if there is a history of recurrent sprained ankles:

- continue to stretch the calf muscles, strengthen the muscles and the balance exercises
- use strapping or an ankle brace
- sometimes a wedge in the shoe will help prevent the ankle from 'tipping over' - this is helpful in those who 'roll' their ankle a lot

Those who chronically sprain the ankle on a regular basis usually need surgery to 'tighten' the ligaments or move a tendon to help stabilize the ankle.

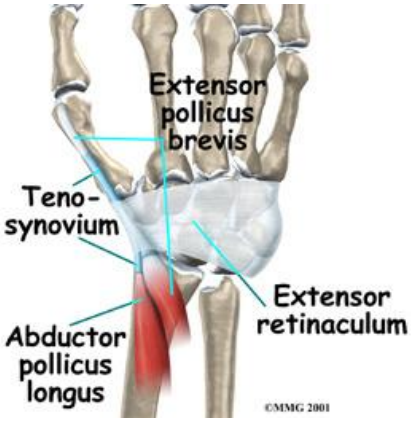
Chapter 6 Review Questions

1. Explain what structures are being injured in a sprained ankle and know what the most common type of ankle sprain is
2. What factors can make someone more susceptible to an ankle injury?
3. What are the characteristics of a second-degree ankle sprain and how should it be treated?
4. Why shouldn't a patient start rehabilitation exercises for at least 48 hours after the injury occurred.

Chapter 7: de Quervain's Tenosynovitis

Introduction

de Quervain's tenosynovitis is a condition that causes pain on the inside of the wrist and forearm just above the thumb. It is a common problem affecting the wrist and is usually easy to diagnose.



Anatomy

de Quervain's tenosynovitis affects two thumb tendons. These tendons are called the *abductor pollicis longus* (APL) and the *extensor pollicis brevis* (EPB).

Tendons connect muscle to bone. Muscles pull on tendons for movement. The muscles connected to the APL and EPB tendons are on the back of the forearm.

On their way to the thumb, the APL and EPB tendons travel side by side along the inside edge of the wrist. They pass through a tunnel near the end of the *radius* bone of the forearm. The tunnel helps hold the tendons in place, like the guide on a fishing pole.

This tunnel is lined with a slippery coating called tenosynovium. The tenosynovium allows the two tendons to glide easily back and forth as they move the thumb. Inflammation of the tenosynovium and tendon is called tenosynovitis. In de Quervain's tenosynovitis, the inflammation constricts the movement of the tendons within the tunnel.

Causes

Repeatedly performing hand and thumb motions such as grasping, pinching, squeezing, or wringing may lead to the inflammation of tenosynovitis. This inflammation can lead to swelling, which hampers the smooth gliding action of the tendons within the tunnel. Arthritic diseases that affect the whole body, such as rheumatoid arthritis, can also cause tenosynovitis in the thumb. In other cases, scar tissue from an injury can make it difficult for the tendons to slide easily through the tunnel.

Symptoms

At first, the only sign of trouble may be soreness on the thumb side of the forearm, near the wrist. If the problem isn't treated, pain may spread up the forearm or further down into the wrist and thumb.

As the friction increases, the two tendons may actually begin to squeak as they move through the constricted tunnel it causes *crepitus*. If the condition is especially bad, there may be swelling along the tunnel near the edge of the wrist. Grasping objects with the thumb and hand may become increasingly painful.

Diagnosis

Diagnose of de Quervain's tenosynovitis is easily done through a physical examination. Most of the time no other tests are required. The major problem can be distinguishing de Quervain's tenosynovitis from *intersection syndrome*, which is a very similar condition.

Careful attention must be paid to where the pain is located--over de Quervain's tunnel near the end of the radius bone, or over the intersection point on the wrist. The intersection point is about three inches up the forearm.

The *Finklestein test* is one of the best ways to make the diagnosis. Bend the thumb into the palm and grasp the thumb with the fingers making a fist with the thumb inside. Now bend the wrist away from the thumb in a side to side motion. If there is pain over the tendons to the thumb, the problem may be de Quervain's tenosynovitis.

Conservative Treatment

If possible, the patient must change or stop all activities that cause the symptoms. Have the patient take frequent breaks when doing repeated hand and thumb actions. Have them avoid repetitive hand motions, such as heavy grasping, wringing, or turning and twisting movements of the wrist. Have them keep the wrist in a neutral alignment. In other words, keep it in a straight line with the arm, without bending it forward or backward.

You may want to your patient to wear a special forearm and thumb splint called a *thumb-Spica* splint. This splint keeps the wrist and lower joints of the thumb from moving. The splint allows the APL and EPB tendons to rest, giving them a chance to begin to heal.

Anti-inflammatory medications may also help control the swelling of the tenosynovium and ease symptoms. If these simple measures fail to control the symptoms, an injection of *cortisone* into the irritated tunnel may be necessary. Cortisone reduces the swelling of the tenosynovium and may temporarily relieve symptoms. Cortisone injections will usually control the inflammation in the early stages of the problem.

Surgical Treatment

If all else fails, the patient might need surgery. The goal of surgery is to give the tendons more space so they no longer rub on the inside of the tunnel. To do this, the surgeon performs a *surgical release* of the roof of the tunnel.

Rehabilitation

If conservative treatment is successful, the patient may see improvement in four to six weeks. The may need to continue wearing a thumb splint to control symptoms. Limit activities that require repeated motions of the wrist and thumb.

Rehabilitation is more involved after surgery. Full recovery could take several months.
Pain and symptoms generally begin to improve after surgery, but the patient may have tenderness in the incision for several months.

Chapter 8 Review Questions

1. What parts of the thumb and wrist cause the problems with de Quervain's tenosynovitis?
2. What causes this condition to worsen and develop?
3. What tests should be done to diagnose this condition and why aren't more tests necessary?
4. What treatment should be tried before surgery is required? And why is rehabilitation more involved for those who undergo surgery?

Chapter 8: How to Tape an Ankle

- Make sure not to apply the tape too tight to avoid cutting off circulation
- Do not start the tape too high up the calf

- Be sure the patient is keeping the foot motionless while applying tape
- Use only athletic tape

Steps

1) Materials needed: pre-wrap, 1” athletic tape, quick drying tape adhesive, and 2x2 squares of nonstick dressing (if available)

2) Ankle is ready for taping. Have patient dorsiflex the foot at the ankle joint. This is important so the tape job is affective in keeping the ankle in a stable position.

3) Apply 2" x 2" dressing to the front and back of the ankle. This is done to prevent blistering.

4) Apply the pre-wrap around the ankle in a figure 8 fashion. Try to avoid any rolling over of the pre-wrap to avoid blistering.

5) Apply more pre-wrap from the arch of the foot to 2" above malleoli (ankle bones).

6) Next, apply the athletic tape. Use 2-3 strips separately as an anchor at the top of the pre-wrap.

7) Apply a strip of tape in a 'U' fashion known as a stirrup. Theses should be done going from the medial anklebone of the leg to the lateral anklebone. Strip #1.

8) Apply strip #2 in a 'U' fashion.

9) Apply strip #3 in a 'U' fashion.

10) Apply circular strips around the ankle to the top of the foot. These are used to secure the stirrups.

11) Apply more circular strips around the ankle to the top of the foot.

12) Apply tape at the end of the pre-wrap and end across the top of the foot. Do this in a figure 8 motion around the ankle as shown above.

13) Then, reverse the direction of the athletic tape (figure 8 the other directions).
14) Apply tape around the heel as a “heel lock”.

All done!

Chapter 9 Review Questions

1. What position should the foot be positioned in before taping begins and why is this important?
2. What are two methods done in order to prevent irritation and blistering?
3. Explain how a stirrup should be applied.
4. What is the fear associated with applying the tape too tight?

Chapter 9: Preventing Sports Injuries

Insoles and external joint supports have shown they may protect athletes against injury

Many devices and methods are used to reduce the risk for sports injuries, but not prevent them. In a systematic review of randomized controlled trials, researchers assessed the efficacy of various interventions.

Five trials examined whether insole use (vs. no use) reduced lower-extremity injuries among military recruits. Each trial showed a 30% or greater reduction in the rate of injury, although this finding was not statistically significant in one study. In four trials, external joint supports were used to help prevent ankle injuries among soccer players and military personnel; three trials showed a significant preventive effect, while the fourth showed a trend toward injury prevention. Similarly, in one trial, knee supports worn by military recruits while playing football significantly lowered the risk for knee injuries, and in two trials, wrist guards worn by snowboarders significantly reduced the rate of wrist injuries.

No protective effect was seen for stretching and warm-up programs, as assessed in three trials.

Comment: In this systematic review, insoles and external joint supports appeared efficacious in lowering the risk for sports injuries. Individuals at high risk for injury or those engaging in high-risk sports such as football may benefit from using such devices. The analysis failed to find a positive effect for stretching and warm-ups. However, as the authors note, high-quality randomized trials of stretching were not available; thus, firm conclusions cannot be made about its effect on injury prevention.

Chapter 10 Review Questions

1. Explain how the use of insoles and external joint supporters may reduce chance of injury, but can't prevent them.
2. Explain how external joint supporters help a complex joint such as the knee from being injured.

Chapter 10: Sports Hernia

A sports hernia occurs when there is a weakening of the muscles or tendons of the lower abdominal wall. This part of the abdomen is the same region where an inguinal hernia occurs, called the inguinal canal. When an inguinal hernia occurs there is sufficient weakening of the abdominal wall to allow a pouch, the hernia, to be felt. In the case of a sports hernia, the problem is due to a weakening in the same abdominal wall muscles, but there is no palpable hernia.

What is the inguinal canal?
The inguinal canal is a region in the lower abdomen, just above the groin. The canal is formed by the insertions of abdominal muscles and tendons, as well as several ligaments. Within the inguinal canal travels the spermatic cord (in males) or the round ligament (in females). This area of the abdomen is prone to weakening of the abdominal wall, allowing a hernia to form.

I have strong abdominal muscles. How can I have a sports hernia?
The problem with the abdominal wall in people with a sports hernia is not a muscle strength issue. Rather, the abdominal wall in a particular region is too thin, allowing the hernia to form. The sports hernia does not occur in the area of the large, thick part of the muscle.

What are the symptoms of a sports hernia?
A sports hernia typically begins with a slow onset of aching pain in the lower abdominal region. Symptoms may include:

- Pain in the lower abdomen
- Pain in the groin
- Pain in the testicle (in males)

Typically, the symptoms are worsened with activities such as running, cutting, and bending forward. Patients may also have increased symptoms when coughing or sneezing. Sports hernias are most common in athletes that have to maintain a bent forward position, such as football players. However, sports hernias are also found in many other types of athletes such as lacrosse, rugby and soccer players.

How is a sports hernia diagnosed?
There are no diagnostic tests that can be used to detect a sports hernia. The diagnosis is made by the patient's history and physical examination. Your physician may perform tests to rule out other causes of groin pain.

What is the treatment of a sports hernia?
There are no treatments that have been shown to be effective for sports hernia other than surgery. That said, the initial treatment of a sports hernia is always conservative in hopes that the symptoms will resolve. Resting from activity, anti-inflammatory medications, ice treatments, and physical therapy can all be tried in an effort to alleviate the patient's symptoms. The importance of being symptom free before returning to high-level activity such as soccer is very high.

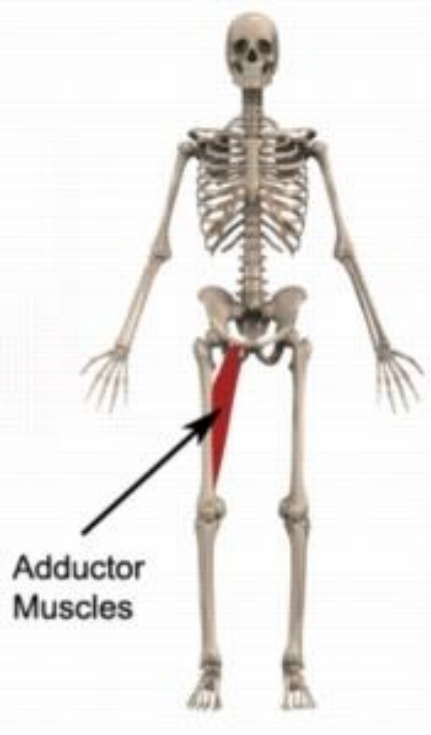
If these measures do not relieve the symptoms of a sports hernia, surgery may be recommended to repair the weakened area of the abdominal wall. In number of studies have shown between 65% and 90% of athletes are able to return to their activity after surgery for a sports hernia. Rehabilitation from surgery for a sports hernia usually takes about eight weeks.

Chapter 10 Review Questions

1. What are the differences between a sports hernia and an inguinal hernia?
2. What is the inguinal canal and what allows for a hernia to form within it?
3. Explain what the symptoms are for a patient with a sports hernia and know if they are slow onset of happen right away.
4. What type of athletes are sports hernias generally found in? Why are they more susceptible to this injury?
5. If a patient has been diagnosed with a sports hernia, but doesn't want to undergo surgery, what should be done to try and avoid surgery? Is a non-surgical recovery common?

Chapter 11: Groin Pull or Groin Strain

What is a groin pull?
A groin pull is an injury to the muscles of the inner thigh. The groin muscles, called the "adductor muscle" group, consist of six muscles that span the distance from the inner pelvis to the inner part of the femur (thigh bone). These muscles pull the legs together, and also help with other movements of the hip joint. The adductor muscles are important to many types of athletes including sprinters, rugby players, soccer players, and football players.



What happens to the muscle with a groin pull?
A groin pull is an injury to the adductor muscles called a muscle strain. When a muscle is strained, the muscle is stretched too far. Less severe strains pull the muscle beyond their normal excursion. More severe strains tear the muscle fibers, and can even cause a complete tear of the muscle. Most commonly, groin pulls are minor tears of some muscle fibers, but the bulk of the muscle tissue remains intact.

What are the symptoms of a groin pull?
An acute groin pull can be quite painful, depending on the severity of the injury. Groin pulls are usually graded as follows:

- **Grade I Groin Strain:** Mild discomfort, often no disability. Usually does not limit activity.
- **Grade II Groin Strain:** Moderate discomfort, can limit ability to perform activities such as running and jumping. May have moderate swelling and bruising associated.
- **Grade III Groin Strain:** Severe injury that can cause pain with walking. Often patients complain of muscle spasm, swelling, and significant bruising. This keeps patient out of activity.

Groin pulls are often seen in athletes who participate in sports such as football, lacrosse and soccer. The injury appears to be related to factors including hip muscle strength, preseason conditioning, and previous injury. Because of this, proper conditioning is of utmost importance to prevent the occurrence of a groin strain injury. Athletes, especially rugby and soccer players, should incorporate adductor strengthening, pelvic stabilization, and core strengthening exercises into their workouts to prevent the occurrence of a pulled groin.

What other problems can cause similar symptoms?
A pulled groin is usually a clear diagnosis. Most athletes know what the injury is before they seek medical attention. However, other conditions can mimic the symptoms of a groin strain.

One condition that was previously not well recognized is called a sports hernia. Sports hernias have been found in patients who were diagnosed with chronic groin strains. The sports hernia is a condition similar to a regular inguinal hernia, and is due to a weakening of the muscles that form the abdominal wall. The symptoms of a sports hernia are often nearly identical to those of a groin strain.

When do I need to see a doctor for a groin pull?
If you have symptoms of a severe groin pull, you should be evaluated for proper treatment. Some signs of a severe groin strain include:

- Difficulty walking
- Pain while sitting or at rest
- Pain at night

Severe groin pulls should be evaluated because in some very rare situations of complete muscle rupture, surgery may be necessary to reattach the torn ends of the muscle. This is rarely needed, even in patients with Grade III groin strain injuries, as these patients can usually undergo successful non-operative treatment.

If you are unsure if you have a groin pull or the symptoms do not quickly resolve, then you should be seen by a doctor. As described above, other conditions can be confused with a groin pull, and these should be considered if your symptoms do not resolve.

Treatment of a groin pull is usually guided by the severity of the injury. Resting a groin pull is the key to successful treatment. As a general rule of thumb, if you have a groin pull, you can do activities that don't aggravate your injury. You should rest until you are pain free to allow the injured muscle to heal. Resting inadequately may prolong your recovery.

The following are the common treatments used for groin strains:

- **Rest**
  It is important to rest following the injury to allow the injured muscle to properly heal. Allow pain to guide your level of activity; this means that activities which cause symptoms should be avoided.
- **Stretching**
  Gentle stretching is helpful, but it should not be painful. Stretching excessively can be harmful and slow the healing process.
    - Adductor stretches
- **Ice the Injury**
  Apply ice to the injured area in the acute phase (first 48 hours after injury), and then after activities. Ice will help calm the inflammatory response and stimulate blood flow to the area.
- **Heat Applications**
  Before activities, gentle heating can help loosen the muscle. Apply a heat pack to the groin prior to stretching or exercising. As a general rule of thumb, remember to heat before, and ice after.
- **Anti-inflammatory Medications**
  Oral anti-inflammatory medications (such as Ibuprofen, Aleve, or Motrin) can help relieve symptoms of pain and also calm the inflammation.

Chapter 11 Review Questions

1. What is the function of the adductor muscles and how many of them are present?
2. What happens the muscles if a groin pull occurs?
3. What are the characteristics of a grade III groin strain?
4. What are reasons why overstretching should be avoided?
5. If a patient comes to you and complains of difficulty walking, pain while sitting, and pain at night, what should be done and why?

Chapter 12: Pes Anserine Bursitis of the Knee

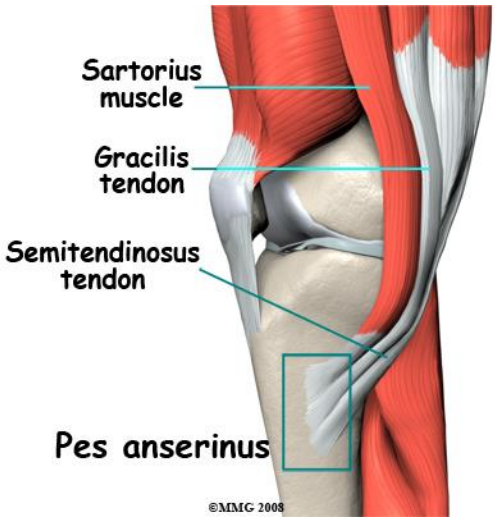
Bursitis of the knee occurs when constant friction on the bursa causes inflammation. The bursa is a small sac that cushions the bone from tendons that rub over the bone. Bursae can also protect other tendons as tissues glide over one another. Bursae can become inflamed and irritated causing pain and tenderness.

This guide will help you understand

- what part of the knee is affected.
- what causes this condition
- how doctors diagnose this condition
- what treatment options are available

ANATOMY

The pes anserine bursa is the main area affected by this condition. The pes anserine bursa is a small lubricating sac between the *tibia* (shinbone) and the hamstring muscle. The hamstring muscle is located along the back of the thigh.



There are three tendons of the hamstring: the *semitendinosus*, *semimembranosus*, and the *biceps femoris*. The semitendinosus wraps around from the back of the leg to the front. It inserts into the *medial* surface of the tibia and deep connective tissue of the lower leg. Medial refers to the inside of the knee or the side closest to the other knee.

Just above the insertion of the semitendinosus tendon is the *gracilis tendon*. The gracilis muscle *adducts* or moves the leg toward the body. The semitendinosus tendon is also just behind the attachment of the *sartorius muscle*. The sartorius muscle bends and externally rotates the hip. Together, these three tendons splay out on the tibia and look like a goosefoot. This area is called the *pes anserine* or *pes anserinus*.

The pes anserine bursa provides a buffer or lubricant for motion that occurs between these three tendons and the *medial collateral ligament* (MCL). The MCL is underneath the semitendinosus tendon.

CAUSES

Overuse of the hamstrings, especially in athletes with tight hamstrings is a common cause of goosefoot. Runners are affected most often. Improper training, sudden increases in distance run, and running up hills can contribute to this condition.

It can also be caused by trauma such as a direct blow to this part of the knee. A contusion to this area results in an increased release of synovial fluid in the lining of the bursa. The bursa then becomes inflamed and tender or painful.

Anyone with osteoarthritis of the knee is also at increased risk for this condition. And alignment of the lower extremity can be a risk factor for some individuals. A turned-out position of the knee or tibia, *genu valgum* (knock knees), or a flatfoot position can lead to pes anserine bursitis.

SYMPTOMS

The patient often points to the pes anserine as the area of pain or tenderness. The pes anserine is located about two to three inches below the joint on the inside of the knee. This is referred to as the *anterior* knee or *proximedia* tibia. Proximedia is short for proximal and medial. This term refers to the front inside edge of the tibia.

Some patients also have pain in the center of the tibia. This occurs when other structures are also damaged such as the *meniscus* (cartilage). The pain is made worse by exercise, climbing stairs, or activities that cause resistance to any of these tendons.

DIAGNOSIS

A history and clinical exam will help the physician differentiate pes anserine bursitis from other causes of anterior knee pain, such as patellofemoral syndrome or arthritis. An X-ray is needed to rule out a stress fracture or arthritis. An MRI may be needed to look for damage to other areas of the medial compartment of the knee. Fluid from the bursa may be removed and tested if infection is suspected.

The examiner will also assess hamstring tightness. This is done in the *supine* position (lying on your back). Your hip is *flexed* (bent) to 90 degrees. The knee is straightened as far as possible. The amount of knee flexion is an indication of

how tight the hamstrings are. If you can straighten your knee all the way in this position, then you do not have tight hamstrings.

NONSURGICAL TREATMENT

The goal of treatment for overuse injuries such as pes anserine bursitis is to reduce the strain on the injured tissues. Stopping the activity that brings on or aggravates the symptoms is the first step toward pain reduction.

Bedrest is not required but it may be necessary to modify some of your activities. This will give time for the bursa to quiet down and for the pain to subside. Patients are advised to avoid stairs, climbing, or other irritating activities. This type of approach is called *relative rest*

Ice and anti-inflammatory medications can be used in the early, inflammatory phase. Over-the-counter *nonsteroidal anti-inflammatory drugs* (NSAIDs) such as Ibuprofen may be advised. In some cases, the physician will prescribe stronger NSAIDs.

Dry needling has proven to be very effective therapy as well as laser therapy or ultrasound. Injecting the area with steroids is also effective.

SURGERY

Surgery is rarely needed for pes anserine bursitis. The bursa may be removed if chronic infection cannot be cleared up with antibiotics.

NONSURGICAL REHABILITATION

Pes anserine bursitis is considered a *self-limiting* condition. This means it usually responds well to treatment and will resolve without further intervention.

Athletes may return to sports or play when the symptoms are gone and are no longer aggravated by certain activities. Protective gear for the knee may be needed for those individuals who participate in contact sports. During the rehab process, activity level and duration are gradually increased. If the symptoms don't come back, the athlete can continue to progress to full participation in all activities.

Chapter 11 Review Questions

What is the purpose of the pez anserine?
Why is it called the 'goose foot?'
What parts of the body are involved?
What causes this problem?
Which sport, and under what conditions can this happen?
What condition of the foot can cause this? How might that be treated?
How is diagnosis made?
What does the condition feel like to the patient?
What treatment options are available? How effective are they?
What is the prognosis?

Chapter 13: Common Running Injuries

Consistent running provides athletes with a myriad of long-term health benefits, with studies showing that runners, on average, live longer and are less susceptible to cardiovascular diseases. However, running remains one of the most common sources of injury among athletes, with over 50 percent of runners getting injured each year according to Yale Medicine. It's important to understand the most common of these injuries, along with learning strategies to keep runners healthy and injury-free.

Shin Splint

Medial tibial stress syndrome, frequently referred to as shin splints, is a common overuse injury among athletes resulting in aching, dull pain along the front of the tibia, caused by repetitive pushing and pulling of the connective muscles and tissues around the bone. The most common root of this injury is a rapid increase in training and/or mileage—hence the reason why this injury is frequent among those undergoing military training as well as runners, due to the sudden increase in time on their feet. Other sources of pain can include running on crowned surfaces—surfaces which slope to one side or another, uneven surfaces, overpronation—the foot rotating too far inward whilst walking or running, or unsupportive or worn-down footwear. Treatment strategies for shin splints include rest or temporary reduction of mileage, compression sleeves for the lower leg, new shoes, and custom orthotics to provide the foot with a better fit in the shoe. Another and relatively new method of treatment is shock wave therapy. Shock waves are delivered to affected area(s) creating tiny tears/traumas to the said area, promoting healing. Shin splint diagnoses are given based on the patient's medical history, a physical exam of the lower leg and foot, and an examination of how the patient walks.

IT Band

Iliotibial band syndrome, or IT band syndrome, is an inflammation and irritation of the iliotibial (IT) band. The IT band is a long band of fascia tissue that runs from the outside of the hip to just under the outer side of the knee. IT band syndrome, like shin splints, is an overuse injury, presenting as pain on the outside of the knee that increases with repetitive bending and straightening of the knee. Normally, when the band is loose, it glides over the knee, but as it tightens, the band becomes irritated from continuous friction as it rubs against the knee or hip bones. This tightness can

stem from a lack of stretching, excessive pronation, uneven or crowned surfaces, unsupportive shoes, or even a naturally tight IT band. Symptoms of IT band syndrome include clicking sensations, hip pain, knee pain, and discoloration on the knee. To treat this condition, doctors suggest knee compression, elevation, a temporary reduction of or break from training, orthotics if the issue stems from overpronation, and, if other methods were unsuccessful, cortisone injections. To diagnose IT band syndrome, look for pain over the greater trochanter, pain at the lateral epicondyle, or pain that worsens when going downhill.

Stress Fracture

A stress fracture is another overuse injury that results in small cracks in the bone. Among runners, this injury is most common in the lower leg bones and foot bones. Stress fractures are caused by an overly rapid increase in training volume. As a runner increases their training load, their bones slowly adapt to the increased load of stress they undergo, necessitating a gradual increase in training. A secondary cause of stress fractures is osteoporosis, a bone disease in which bones become fragile and brittle. People with osteoporosis lose bone faster than their bodies can create it, making them particularly susceptible to stress fractures. Treatment of stress fractures includes the following: temporarily pausing physical activity, compression, immobilization, elevation, and depending on the type of fracture, a walking boot, brace, and/or crutches may be necessary. In some cases, surgery is required. An X-ray is needed to diagnose stress fractures.

Achilles tendinitis

Achilles tendinitis is an injury affecting the achilles tendon, which attaches the gastrocnemius and soleus muscles to the calcaneus, or heel bone. The tendon allows the heel and foot to move. The injury largely stems from overuse, which forms small tears in the tendon. Other contributing factors include overpronation, unsupportive footwear, and obesity, which puts excessive stress on the tendon while standing and walking. There are a few strategies to mitigate or eliminate achilles tendinitis, including temporarily reducing or pausing training, warming up and stretching, custom orthotics, and shock wave therapy for more severe cases. If deemed necessary by medical professionals, gastrocnemius recession may be required, in which surgeons lengthen the gastroc tendon, allowing the heel to shift downward. The procedure also releases any tight calf muscles that may be the root of the problem. Doctors avoid steroid injections into the achilles due to the chance that the tendon will rupture afterward. Symptoms of achilles tendinitis include pain in the back of the heel, pain while walking or running, and swelling and tenderness of the tendon. To diagnose achilles tendinitis, doctors look for pain and tenderness along the tendon, particularly when the patient stands on their toes. Doctors may also run a series of imaging tests to confirm their diagnosis, including an X-ray to rule out other potential issues, an ultrasound to view the tendon's movement and blood flow in the area, and an MRI to investigate potential tears in the tendon.

Runner's Knee

Runner's knee, or patellofemoral pain syndrome, is a frequent running injury that causes pain at the front of the knee, around the patella. A number of factors play into the injury, including overuse, muscle imbalances in and around the knee, and previous injuries. Younger people, women, and those who have undergone previous knee surgeries—particularly ACL repair using the patient's own patellar tendon—are more susceptible to runner's knee. Treatment involves rest, elevation, physical therapy to build the supporting muscles around the knee, a temporary training reduction or hiatus, and, in extreme cases, patellofemoral release surgery, which loosens tight tissues around the knee, allowing the kneecap to shift back into a more normal position. As always, surgery is only for cases in which all other forms of treatment have failed. Signs of runner's knee can include pain in and around the patella when engaging in physical activity, clicking and/or grinding sounds when the patient bends or extends their leg, and tenderness to touch. Patellofemoral pain syndrome is often diagnosed based on the following factors: pain while squatting, lateral or medial patellar tenderness, and the patellar apprehension test, patellar tilt test, and Clarke test.

Blisters

Blisters on the feet are a persistent problem among runners, particularly long-distance runners. Blisters are formed when a fluid known as serum or blood fills the space between the outer layers of the skin as a reaction to injury/trauma to the skin. The reaction is actually a protective measure on the body's part, as the serum protects the layers underneath from sustaining damage. These serum blisters are caused by friction on the skin. Blood blisters, alternatively, form when the skin gets pinched and blood enters the area through the broken blood vessels. To treat these skin lesions, patients can wash the affected area(s) gently, bandage or gauze the area(s), and apply cream or ointment to accelerate healing. Ideally, however, runners can prevent blisters in common spots by reducing the friction on their feet. Moisture on the foot is one cause of increased friction, therefore wearing moisture-wicking socks helps by wicking water and sweat away from the skin. Other methods include applying duct tape to problem areas, wearing looser-fitting shoes, lubricants, and even antiperspirants, which help with the moisture problem. Blisters present as pain on the affected areas, most commonly found on heel, foot arch, and on the edges of the big and little toe joints, which come in contact with the sock most. Patients can typically self-diagnose blisters without help from a medical professional.

Pulls/Tears

Muscle pulls and tears are injuries to the muscle or tendon from either overstretching or tearing these tissues. It's important to understand the distinctions between sprains, strains, and tears in diagnosing and treating patients. A strain is an injury to tendons or muscles. A sprain, conversely, is an injury to the ligaments and joint capsules. Tears are full or partial tears of these ligaments, tendons or muscles. Common muscle tears for runners include the hamstring and gastroc muscles. Acute strains and tears result from a single event such as pulling, lifting, or pushing, while chronic strains result from stressing a muscle or tendon due to repetitive use of a

muscle or repetitive movements. Rest, compression sleeves, elevation, and ibuprofen typically suffice to heal muscle strains and tears. Symptoms of strains and tears include swelling, bruising, pain, muscle spasms, and limited range of motion. Tears have a few unique symptoms like severe pain immediately after injury, a "pop" sound upon injury, and the feeling of a loose joint. Doctors can diagnose strains and tears by performing a physical exam to observe tenderness and swelling. In some instances, tears are visible by ultrasound.

Plantar Fasciitis

Plantar fasciitis, put simply, is heel pain. The plantar fascia is a tissue band that connects the heel (calcaneus bone) to the toes. Whenever the band bears weight, it stretches. When the band is constantly subject to load-bearing, the tissue can tear, creating inflammation along the band. Overuse, an increase in training, overpronation, running on crowned surfaces, and unsupportive footwear can all contribute to tiny tears in the plantar fascia, resulting in pain. People with high or flat arches are more susceptible to plantar fasciitis due to constant tension on their plantar fascia. There are a few indicators of plantar fasciitis, including pain upon standing (particularly just after waking up), a sharp pain on the bottom of the foot, pain when climbing stairs, pain that worsens with exercise, and tenderness when touching the area. To diagnose plantar fasciitis, doctors will conduct a physical exam to observe tender areas, and may request soft-tissue imaging tests such as an MRI or ultrasound to get a better look at the plantar fascia tissue.

Stretching, specifically those focused on the plantar fascia and achilles tendon, have been shown to combat plantar fasciitis. Exercises focused on strengthening the muscles and tendons around the ankle also help to avoid the injury. If those strategies are ineffective, patients can seek further treatment if their case is severe, including shock wave therapy, cortisone injections, and, if all else has been unsuccessful, gastrocnemius recession, which helps to achieve a more natural foot arch shape.

Staying healthy

Just as crucial as recognizing and treating the preceding injuries is implementing strategies in athletes' routines that help to avoid them altogether. Certain practices outside of an athlete's training, along with tweaks during the act of training, can have a major impact on injury reduction.

One method to reduce impact, and accordingly injury, from running is to minimize load rates on the feet. There are many variables that contribute to forces on the feet while running, including the runner's strike pattern and shoe cushion type. The University of Exeter conducted a 2016 study examining the total ground reaction force on a runner's foot based on strike pattern and shoe type. They found that in a standard cushion shoe, both rear-foot strike and fore-foot strike patterns had similar total load rates on the foot. However, a minimal shoe combined with a fore-foot strike running pattern proved to be the most effective combination in minimizing total ground reaction forces on the foot. This study contradicts the

popular belief that greater cushion in a running shoe results in less injuries. Another misconception is that frequently changing out one's running shoes decreases the probability of running injuries. The medical journal *BMC Research Notes* measured plantar pressure forces in new and worn running shoes and found that plantar pressure was significantly higher in new running shoes than old shoes. They emphasized the importance of slowly breaking in one's running shoes and changing them out around every 500 miles. A third method of reducing running injuries is the use of orthoses, commonly called orthotics. The *British Journal of Sports Medicine* found that running with orthoses had no impact on the frequency of soft-tissue injuries, but it was effective in avoiding stress fractures and overall injuries such as shin splints. Orthoses have been shown to reduce running economy, which may be a deterrent for elite distance runners, but to most of the population orthoses exist as an effective strategy to minimize the risk of injury.

The literature regarding the impacts of stretching before running is inconclusive but suggests that there is little to no effect of stretching before running on the likelihood of injury. However, according to a survey in the Clinical Journal of Sports Medicine, 95% of high school coaches feel as though stretching is beneficial in decreasing the risk of injury among athletes, and 73% believe there are no negatives of stretching. This strong, positive association between stretching and injury reduction among coaches, despite no supporting evidence, suggests potential injury-mitigating benefits that have yet to be seen in the medical community. Currently, however, no endorsement or denouncement of stretching to reduce running injuries can be made without further studies.

Aging and Running–not yet edited

As runners age, they're oftentimes told to take it easy and lessen their training. However, the *Annals of Internal Medicine* suggests this might be counterproductive to avoiding injury. In an 8 year longitudinal study comparing the effects of aging on 50+ year old runners and non-runners, the non-running group was subject to significantly more increase in musculoskeletal disability, and were even more likely to die. There is an elevated risk of injury compared to younger runners, though, with runners over 60 being about 10% more likely to be injured than runners under 60, according to the Research Academy of Grand Health. Furthermore, the risk of cardiac injury is slightly elevated in the older running population as compared to younger runners, with marathon runners over 50 seeing a "transient, yet reversible increase in cardiac biomarkers and RV systolic dysfunction" in a study from the *Journal of Cardiovascular Magnetic Resonance*. ACE Physical Therapy and Sports Medicine Institute recommends strength training as the primary method of avoiding injury for older runners, as a person, on average, loses about 50% of strength as they age from 50 to 80, leading to a myriad of potential injuries.