

**A Mom's Guide to  
Sports Medicine  
for Kids**



**Dr. Randy Goldstein**





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with an interest in Sports Medicine

**Founder of wellbody**  
Focused on the healthcare of athletes

*Illustrated by Eve Goldstein*

With his pediatric residency training at the University of Kansas Medical Center along with his passion for sport as a past competitive gymnast- Dr. Goldstein has collected his own experiences of sport along with his education in medicine in coming up with a book for parents and coaches to guide their young athletes to a fun- and safe- experience during their competitive career in sport.

Currently, Dr. Goldstein assists several youth, premier level sports teams in the Kansas City area with their sports medical concerns. Whether soccer, gymnastics, swimming, or baseball- your children and their teams will benefit from this **simple to read, accurate, sports friendly guide to sport's care for kids.**

*This book is dedicated to young athletes  
who watch in awe the Olympians of today,  
who dedicate their life practicing the sport they love,  
and who dream of becoming the next super star athlete...  
who the next young generation will watch in awe.*

**This book was written with the premier level athlete in mind. It is intended for parents, coaches, and athletes to better understand health issues in sport, and better prepare for their visit with a health care professional.**

Is “take two weeks off” not an option?

Does the coach seem irritated that you looked for recommendations from someone other than a coach?

Do you want to know what to ask your doctor to see if he or she is considering a “sports friendly approach?”

**This book may be just what you need!**

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### **RULE OF THUMB:**

Occasionally a “pearl” or “rule of thumb” is presented in this dashed box. Although not absolute- it might be considered something important enough to read twice and consider.

# Glossary

Treatment Strategies- These are the opinion of the author and NOT based on research or fact. Consideration should be made for each athlete individually and with the recommendation of a health care provider.

## ***Treatment strategies: Dr. Goldstein's opinion***

Surgery (for example) in a simple clavicle (collar bone) fracture would be a treatment strategy of 0 while surgery in a case of appendicitis would be a 5

- 0 This modality has no place in treating this condition (with rare exceptions)
- 1 This modality is used but not commonly, or with risk or harm associated
- 2 This modality is often used but not very helpful
- 3 This modality has above average positive outcomes with little risk
- 4 This modality is the choice for most cases in non-athletes, but may not be an aggressive choice for an athlete
- 5 This modality is the expected standard of care for this diagnosis in almost every case (there are, of course, always exceptions!)

**Asthma-** An obstructive lung disease that is chronic and normally reversible with bronchodilators such as albuterol. Categories of asthma include intrinsic and extrinsic asthma- allergic triggered asthma, exercise induced asthma, reactive airway from viral illness, cough variant asthma, and there is a genetic component

**Concussion-** traumatic brain injury after an impact, or whip lash without impact causing symptoms such as a headache, vision disturbance, nausea, dizziness, memory loss, and possibly, but not in every case, a loss of consciousness

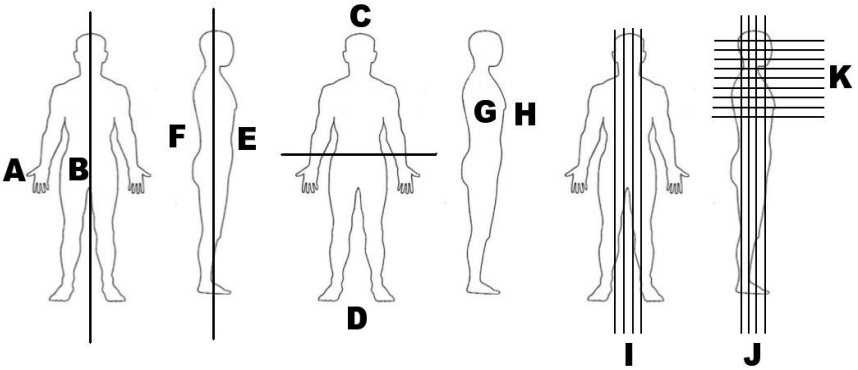
## **Connective Tissues:**

**Ligament-** connective tissue that is in between two bones such as the anterior talofibular ligament connecting the talus and fibula in the ankle or the Anterior cruciate ligament connecting the femur and the tibia in the knee

**Tendon-** the connective tissue that connects a muscle to a bone such as the Achilles tendon from the calf muscle connecting the heel in the foot or the triceps tendon from the triceps muscle connecting to the elbow in the arm.

**Sprain-** the injury to a ligament that is partial or complete separation of connective tissue fibers

**Strain-** the injury to a muscle that is partial or complete separation of muscle fibers



**Directions in medicine:**

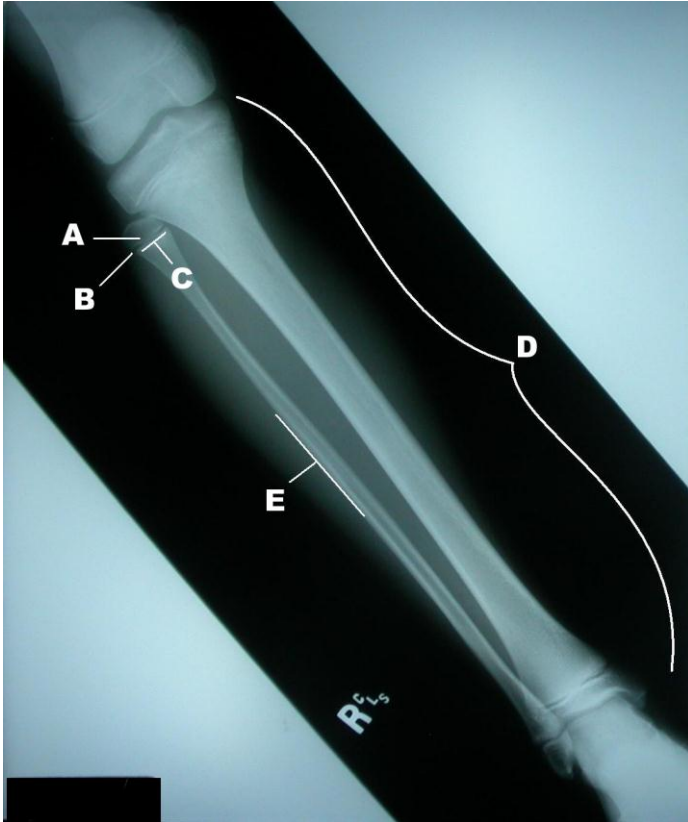
- A. Lateral- outside, “the ears are lateral and nose is medial”
- B. Medial- inside, “the nose is medial and the ears are lateral”
- C. Superior- top, “the head is superior and feet are inferior”
- D. Inferior- bottom, “the feet are inferior and the head is superior”
- E. Anterior- front, “the chest is anterior and the back is posterior”
- F. Posterior- back, “the back is posterior and the chest is anterior”
- G. Interior, inside “the interior is the stomach and the exterior is the skin”
- H. Exterior, outside “the exterior is the skin and the interior is the stomach”
- I. Sagittal- radiology reports with the “cuts” from left to right
- J. Coronal- radiology reports with the “cuts” from front to back
- K. Axial- radiology reports with the “cuts” from top to bottom

**Musculoskeletal-** pertaining to the system of the body dealing with muscle, tendon, ligament, bone, and the connective tissue between each of the parts of the anatomy



**Bone and Growth Plate Definitions:**

- A. Epiphysis- the end of a growing bone
- B. Physis- the cartilage “growth plate”
- C. Metaphysis- the edge of the long bone next to the physis
- D. Diaphysis- the long bone
- E. Periosteum- the “skin” or outer layer of bone



**Salter Harris Fracture-** a growth plate fracture

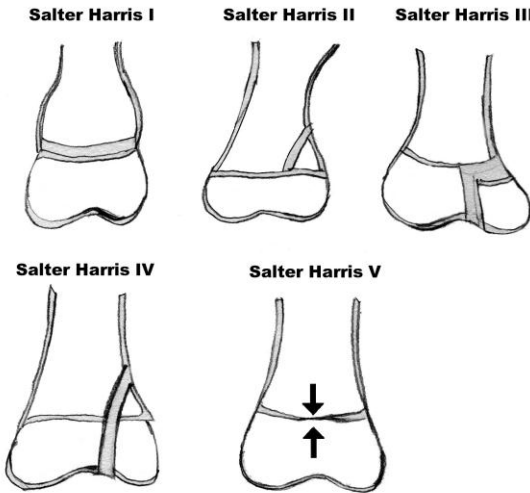
**Salter Harris (SH) I fracture-** a fracture at the actual growth plate (physis) often not seen on x-ray (many times a clinical diagnosis), a widening or compression of the physis such as a “gymnast wrist” (distal radius Salter Harris I fracture)

**SH2 fracture-** a fracture at the metaphysis into the physis (the most frequent Salter Harris fracture seen)

**SH3 fracture-** a fracture at the epiphysis into the physis

**SH4 fracture-** a fracture through both the epiphysis and metaphysis

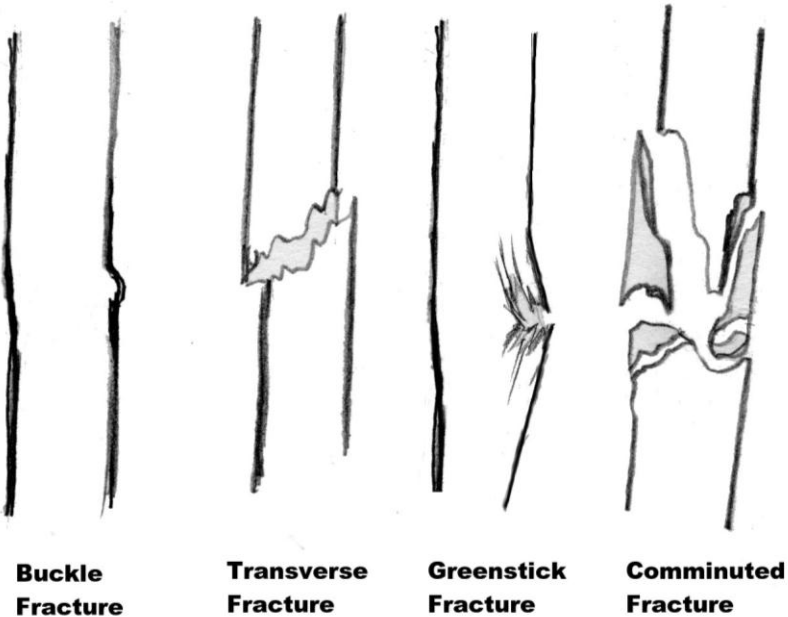
**SH5 fracture-** a crush injury involving the growth plate (physis)



**Fractures:**

These are examples of some fractures. The transverse fracture is the one that most people think of with a “broken bone” but the others are quite common in children and adolescents. Bone at this age is relatively soft compared to adult bone and it may crumple (buckle) with moderate forces rather than snap (transverse) as it would in an adult. Still, if the force is great enough, young bone will result in transverse fractures.

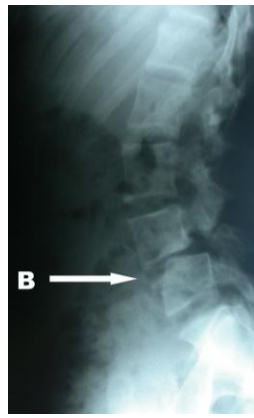
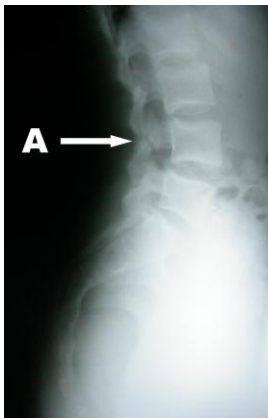
Fractures, sometime subtle, as in the buckle fracture below, are common in pediatrics. Tendons and ligaments are relatively stronger and may withstand trauma better than the growing bone which often is the piece that “loses” during a trauma. While an adult may simply sustain an ankle sprain (or jammed finger), consider a distal fibula fracture of the ankle (or growth plate fracture in the finger) with the same mechanism of injury in a child.



Stress fractures:

A stress fracture is typically an overuse injury where the bone can't withstand the chronic impact and finally "gives up"- causing pain and inflammation. Sometimes it is seen on x-ray, while some stress fractures can only be detected by bone scan or MRI. Examples include long bone stress fractures such as the tibia in runners or metatarsal bones in a gymnast. It can also occur in the back:

- A. Spondylolysis- the stress fracture in the back at the pars interarticularis most commonly at Lumbar segment 4 or L5
- B. Spondylolisthesis- the slippage of the spine where there is a bilateral spondylolysis graded 1-4
- C. A stress fracture may not be seen on x-ray but detected on bone scan (or MRI)



C



## The Knee Ligaments and Cartilage:

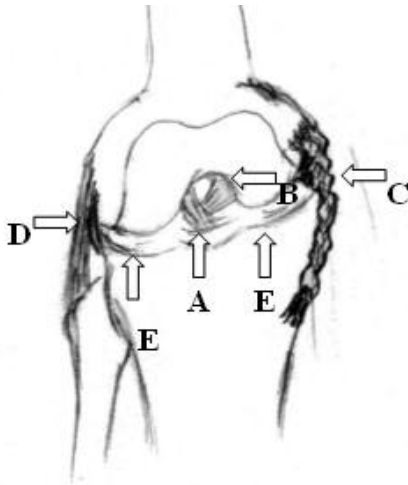
**A.** Anterior Cruciate Ligament (ACL)- the ligament in the knee that prevents the tibia from going too far anterior

**B.** Posterior Cruciate Ligament (PCL)- the ligament in the knee that prevents the tibia from going too far posterior

**C.** Medial Collateral Ligament (MCL)- the ligament in the knee that prevents the knee from going too far medial, this picture shows a sprained MCL (it looks crumpled instead of tight)

**D.** Lateral Collateral Ligament (LCL)- the ligament in the knee that prevents the knee from going too far lateral

**E.** The two cartilage “pillows” between the tibia and femur are called the medial and lateral meniscus.



**Shoulder Rotator Cuff**- Four muscles stabilizing the shoulder joint sometimes referred to as the “SITS” muscles- supraspinatus, infraspinatus, teres minor, and subscapularis muscles. Adolescents can have an inflamed rotator cuff which cause pain, but almost never tear it.

## Physical Therapy Terms:

**Proprioception**: the “memory” of a muscle that is lost with a sprain or fracture around the muscle. An example of good proprioception would be the ability of standing on one foot without falling- and after an ankle sprain the same person is unable to stand on one foot.

### **Common bones discussed in the book**

Skull- the bone of the head, also called the cranium

Mandible- the jaw

Cervical spine- the neck bones made up of 7 vertebrae

Thoracic spine- the spine with the ribs attached made up of 12 vertebrae

Lumbar spine- the lower back made up of 5 vertebrae

Sacrum- the lowest portion of the back, where you sit

Coccyx- the tailbone

Humerus- the single arm bone above the elbow

Ulna and Radius- the two lower arm bones below the elbow

Carpal bones- the bones in the hand

Metacarpal bones- the long bones in the hand

Phalanges- the fingers and toes

Femur- the long leg bone above the knee

Patella- the knee cap

Tibia and Fibula- the two lower leg bones below the knee

Tarsal bones- the bones in the foot

Metatarsal bones- the long bones in the foot

Calcaneus- the heel bone

### **Level of Sport: see page 23**

1. Recreational- “just for fun”, little or no competition
2. Select- try out for a team with “low stress” competition
3. Premier- try out for a team with clear goals of achievement and advancing to the next higher level
4. Elite- national and international level competition
5. Olympic/Professional

**Return to Play Guidelines: see page 24**

**This text is NOT an authoritative medical resource. It is intended to offer accurate information for parents and coaches to better understand several sports medicine topics and increase their knowledge to better communicate with their child’s health care provider. The information is NOT exhaustive and may change as new information is learned or researched.**

## “The Starting Line”



## **Introduction:**

It is about time that parents (and coaches) with premier level athletes are brought up to speed on their child's health care in an easy to understand, sports friendly book.

Your coach updates you on the tournament schedule, the newest skills expected of your child, and the best ideas in the national arena of your sport. Why doesn't your doctor update you on the newest treatments, the safest, quickest way back to sport, and the accepted practices of today? The truth is there is so much information out there- your child's doctor may be having a difficult time keeping up. They are likely reading medical journals, but it could be about how to treat high cholesterol, new medicines for sinus infections and other non-sports related topics that are important in the medical field as well.

It's possible that you, the parent, or your child's coach knows more about your child's situation than the doctor- especially if it is chronic and you have had time to research the medical literature. That does not mean, however, that your doctor isn't good, or doesn't know what he/she is doing. There are so many topics in medicine today- and so much research and new information- rather than saying "my doctor doesn't know"- it's safer to say, "how could I expect my doctor to know everything!?". That's why, in today's world of medicine, far fewer doctors claim to "do it all" while more and more specialize in a specific area of medicine such as the heart (cardiology) or the lungs (pulmonology). Your general family medicine or pediatric doctor may have an idea of what to do but choose to send you to a doctor more experienced, more interested and well-read, or more trained in that area. Sports medicine has indeed become its own specialty.

### **A real life example-**

Let's start with your child's doctor- most likely a pediatrician, family practice doctor, or general care provider. Let's also presume they are excellent- most doctors clearly want what is best for their patient- and want the patient happy and healthy. Your child's doctor may have been around since your first child's birth- in fact, your doctor is practically part of the family. But with hundreds of medicines, thousands of diagnoses, and dozens of specialists in every type of medicine- your doctor can not (whether you believe it or not) know everything about dermatology, pulmonology, cardiology, nephrology, and sports medical care. They probably know a variety of colleagues knowledgeable on each separate topic- but with scientists learning new things every day- even the specialists in each field are having a hard time keeping up. Patients are learning things on the internet faster than research can be disseminated to physician's offices. It is remarkable.

And so- if your child's doctor is giving advice that seems different than another team-mate's doctor- it is likely that one of the doctors is more interested in sports care than the other. And the truth is, they are both excellent- and both



recommendations may be correct, but one solution may be more “sport’s friendly” than the other.

And so the typical “safe but not necessarily best recommendation” is commonly made by the doctor... “Take two weeks off”... is just not the acceptable treatment for many of today’s athletes.

And the pediatrician interested in child development, constipation or diabetes may know far more than the general doctor on these topics, but offer little advice (or unknowingly poor advice) about your child’s ankle injury. And waiting to get to an orthopedic surgeon can take longer than the two weeks your doctor has already suggested your child rest. Your doctor may presume that things will improve over two weeks without realizing that your child has a tournament in five days. Your doctor may also presume that if, for some reason, things don’t get better in two weeks, an orthopedic colleague can take over for more care. Typical children may be sad they can’t go out and play, but a premier level athlete realizes two weeks of rest could jeopardize the end of a season, upward movement on the team, a college scholarship, or a national title. Young athletes today have a difficult time being satisfied waiting for two weeks- to see if things get better. And young athletes today may be even more dissatisfied waiting two weeks to have another doctor, the orthopedic surgeon, offers treatment that could have been started two weeks sooner.

*Ask the doctor treating your child, “Is this recommendation based*

- 1) on the medical school textbook from several years ago (questionably good but possibly still standard of care),*
- 2) on the latest article from a sport’s journal (better than a textbook and more up to date),*
- 3) or your daily experience treating athletes? (the best in almost every case)”*

So what now? Do you take the advice of your doctor, hoping the advice is sports friendly, with the safest, quickest way back to sport? Or do you listen to your neighbor, your non-medically trained but over enthusiastic child’s coach, or the testimonial experiences of the parent of one of your child’s team-mate’s while feeling guilty not doing what your doctor recommended. And this isn’t the mechanic giving questionable advice about your car... this is your child! Everyone wants him playing in the next game- but ultimately- his health is paramount!

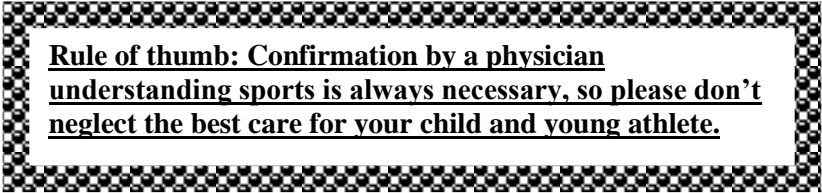
“Is the doctor playing it safe or is the recommendation actually necessary for proper healing?” And why am I, the parent, having to consider this?

It would be nice getting advice- from someone medically trained (not necessarily from the parent who just read something on the internet!)- and trust

that the recommendation is up to date, sport's friendly, and safe for your child to return to sport as quickly as possible.

I hope this book will give you some relief.

The information within this handbook is not meant to diagnose your child. It is merely a compilation of common sports injuries and topics that may be encountered during adolescence. Treatment and therapy are possible options but not absolute or specific to your child's situation. Questions are offered for you to ask your physician to get a better idea of his/her plan, gain confidence in the diagnosis and treatment options, and learn more about your child's condition.



**Rule of thumb: Confirmation by a physician understanding sports is always necessary, so please don't neglect the best care for your child and young athlete.**

Coaches, athletes, and parents will be taken through injuries by the athlete's anatomy. Illustrations and text are in language that is easy to understand. This is not a medical text! But it will help you understand medical information that your doctor tells you.

The most common injuries are **highlighted** and less common scenarios are illustrated in boxes. These boxed areas are given to help you understand the complexity of decision making for your doctor- just because your child's team mate was diagnosed with a stress fracture in the heel does not mean your child's heel pain is the same thing. *Medicine is not easy*... there is no computer to plug you into like your mechanic does with your car. Some diagnoses are straight forward while others require multiple visits, referrals to specialists, or physicians particularly interested in your child's type of problem.

And once the diagnosis is determined, there is more than one way to take care of it. One treatment may be no better than the other, but it may seem more friendly or practical depending on the patient's desires.

The treatment for a broken little toe may require six weeks of splinting and restricted activity and seem like *excellent* care to the parents of a recreational seven year old soccer player. On the other hand, the parents of an eleven year old premier level soccer player with the same injury may find this treatment illogical and simply tape the broken toe to the one next to it and play in the game that Saturday.

For this injury, there is likely no wrong answer, and each parent should be offered both options- picking the one best for their child's situation. In the "old days" one option was given by the doctor and the family went home relieved that

their doctor was smart enough to know how to treat their child. In today's internet savvy environment, families know that there is often more than one option. Depending on the situation, option "A" may be correct, while in a different family it may seem completely impractical and option "B" become the best recommendation.

Therefore the doctor treating your child may offer several options. The first option may be the "textbook way" to treat your child's diagnosis. It is likely the most proven, protective, guaranteed treatment- with the least medical risk involved. Doctors often refer to this as "**the textbook case**".

The next option may be based on the experience of the physician. Statements such as, "the book suggests this, but **"in my experience"** over the past ten years, I have found that this works even better." This option may not be as well studied but the doctor feels it is safe and effective.

The physician may then offer options that he has read about, seen colleagues use, or offer "**off-label**" strategies. These are likely unproven, more risky, but possibly, with good communication and follow up with the doctor, the perfect option in a unique athlete's situation.

*The questions in each situation are,*

- 1 *"did I get all the safe options offered for treating my child's injury?"*
- 2 *"Is my child's doctor looking out for what is best and considering the level of sport my child plays and my child's goals?"*
- 3 *"Is there advice that is equally safe but possibly more sports friendly?"*

**Here is a real life example.**

A seventeen year old premier level soccer player is found to have a stress fracture in his tibia (leg bone) the week before the final game of his Junior year in high school. His family knows that recruiting agents from several college teams will be at the game watching to make decisions on scholarship awards. Although he is not limping in the office, he is in moderate pain. He is anxious about the treatment since he has been playing soccer twelve years for the dream of playing on a NCAA Division I college team one day. His sports friendly doctor offers these options:

I: **The textbook** says non-weight bearing activity for about six weeks followed by physical therapy. Return to sport only when you are completely pain free.

II: **My approach**, with nine years experience, is slightly different than the textbook- but I believe equally good. You can walk on the leg, start physical therapy, and do pain free activity- although soccer is most likely not included in this treatment plan.

III: The doctor realizing the importance of the game in a week says, "although I can't recommend as safe and advised, here is an **"off label"** option we

can consider”. Rest before the game, use ice and non-steroidal medication. If you are not limping, play the best you can and immediately after the game, return to my office for a recheck and decision on how to proceed. There is a chance that this could make the stress fracture worse and likely it will cause you pain. It may increase the time needed for healing but hopefully the college recruits will be impressed with your dedication and you will have the summer to heal. Although pain is not something I desire in a treatment plan, and you will likely have some pain- I realize the importance of this game, and also that the diagnosis is not life-threatening if you play one more game. And by the way, I doubt you will play as well as if you didn’t have a stress fracture- so keep that in mind with your expectations for the game.”

This communication allows the family to realize that the doctor does not believe it is the best method of treatment, but possibly for this unique situation- a “non-textbook” way of handling the problem may be best for this athlete. It does require the additional time for explanation (often not possible in a busy private practice), trust in the relationship and follow up between the family and doctor (often not possible in a one time visit to an urgent care or emergency room type encounter)...

**Rule of thumb: (THE EMERGENCY ROOM IS RARELY THE PLACE TO GET SPORTS MEDICINE RECOMMENDATIONS- use the ER for emergencies only!).**

and understanding that there is some risk by not following the “textbook” (difficult to calculate for physicians not treating a large number of athletes each year and with every situation different). But it does allow for options!

Most importantly, the doctor was willing to modify the options according to the patient’s level of play. It gives the family some choices and also some trust that the doctor is looking out for what is medically best while also giving some “off label” choices as well. This could NOT have been done in a life-threatening diagnosis such as a neck fracture, uncontrolled severe asthma, or an untreated heart condition- the more serious the diagnosis- clearly, the fewer options should be considered. It does allow the family to be in charge of their outcome- with education, clear understanding of added risk, and the patient’s desire to continue sport if not 100%- the doctor has offered something other than, “take two weeks off” (although taking two weeks off would be medically correct as well).

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Dr. Randy Goldstein is a board certified pediatrician with an interest in sports medicine. He is the team physician for several premier and elite level teams in the Kansas City area. Dr. Goldstein participates in the health care of several

Olympic level athletes and shares their care with experts in physical therapy, psychology, orthopedic surgery, and nutrition.

This handbook is the opinion of Dr. Goldstein’s approach to medical practice with athletes and is not intended to be interpreted as the only way to handle healthcare in athletes. It is meant to be a resource for parents and coaches to get information about common sports problems and be able to ask their doctor appropriate questions to gather more information.

**This handbook is not intended to replace a visit to a physician. Your child’s specific injury, healthcare condition, or problem can not be fully accessed with this handbook. Included are some of the more common sport’s injuries and problems found in young athletes, but it is not an exhaustive list nor is any one condition fully explained.**

**Rule of thumb: Confirmation by a physician understanding sports is always necessary, so please don’t neglect the best care for your child and young athlete.**

# Chapter 1:

**Level of Competition,  
where is my child in all of this?**



# Chapter 1: Level of Competition, where is my child in all of this?

Whether soccer, gymnastics, or ice hockey, your child likely dreams of the Olympics, professional sport, or a college scholarship. He or she may be asked, “What are you going to do when you grow up?” The answer may be, “I’m going to play football”... or “I’m going to the Olympics.” This dream may or may not become reality- but it is years before anyone will really find out!

It is important for you to understand the coach’s potential and goals for your child’s athletic future. One coach may desire the team to have fun, participate in different positions during the game, and get equal playing time. Another coach may be interested in the state title, and national level competition. If you, as the parent, want your child to take part in a relaxed, low stress level of competition, the second coach may not be a good match for you and your child!

It is just as important for you to understand your physician’s goals and understanding of your child’s athletic future. A twelve year old non-athlete playing on the playground and injuring his knee is handled differently than a twelve year old elite level gymnast who has a competition in three days- even if the injury and the diagnosis may be the same in both children.

Here is how this book will separate the level of an athlete.

**Adolescence is defined as ten years to eighteen years old.** This book is written with adolescent athletes in mind.

**Recreational:** a person of any age who plays to enjoy without concern for competition or moving up in level a factor in their playing. A child on the playground who falls down and decides to quit playing without a parent or coach asking them to return to the activity is an example.

**Select:** an athlete who is asked to try out for a team. Typically 6-10 years old with low-pressure competition between other children the same age and the same skill level. Coaches are involved and may be interested parents. When this athlete falls down, the coach or parent encourages them to return, but doesn’t demand a return. Grade school level sport and most YMCA are regulated by this level of activity.

**Premier:** These athletes are dedicated to one or two sports, spending more time at these activities than home or school at times. Competition involving travel is common, as is increased expenses, and heightened expectations. Athletes typically identify themselves as a team member of a particular high- level group. Athletes range from 7-18 years old. Coaches are typically professional and not the parent. When this athlete falls down, coaches and parents may encourage return to sport even if the athlete is reluctant.

**Elite:** Still considered premier, but now involved in international level competition as well as Olympic and college level recruitment. Although not every Elite “makes it to the Olympics”, they are certainly realized as potentials by coaches, parents, and the national sports organization. Typically 13-18 years old. Considered by many to be a career rather than just a sport. Injuries may be “part of the deal”.

**Olympic and Professional:** These athletes are in the media, and either paid or heavily marketed by companies (the Wheaties box). Typically age 16 and above. The sport may be secondary to National Medals, international media, and career long goals. Injuries in these athletes can be marketing and career ending nightmares.

This book was written with the Select, Premier, and Elite level athlete in mind. While parents of recreational athletes may find the information interesting, most parents are not in the position of having to restrict activity- the child may decide by themselves that they wish not to continue. And most Olympic and Professional level athletes have physicians working with the team involved with moment-by-moment decisions on return to play or restricting activity criteria- and the parents are more spectators than decision makers.

The book will however distinguish the Recreational/Select and Premier/Elite decision-making strategies as slightly different. And remember- these are big ideas only- not specifically written for your child’s injury. **Please seek medical attention from a sports-friendly medical provider for your child’s situation.**

## **Guidelines of return to play options**

**Full activity-** in football this is called “full contact” allowed

**Relative restriction-** this explains practice allowed but care should be taken with the area injured. A baseball player with a broken foot may bat but not run. This term is used throughout the book.

**Complete restriction-** an athlete can not practice or compete until cleared by a medical provider. An example would be a concussion or severe illness.

This restriction is usually for the safety of the ill or injured athlete- but in some cases may be for the safety of the entire team- for instance an athlete with strep throat should have complete restriction until not contagious (typically 24 hours after antibiotics) to avoid the entire team being exposed to the illness. “One member down, no matter how important he is to the team, is always better than the whole team down.”

**Termination-** this unusual situation occurs when an athlete can never return to a particular sport. An example would be repeated concussions, paralysis, or other unusual medical conditions.



## **Chapter 2:**

### **“No Pain, No Gain?” The Psychology of getting to the top.**



## Chapter 2: “No Pain, No Gain?” The Psychology of getting to the top.

“No Pain, No Gain!” This quote has been used for generations. It is explained by many pediatricians as parents and coaches pushing kids too hard and the cause for the increased number of stress fractures, athletic caused injuries requiring surgery, and potentially eating disorders, and mental health concerns such as anxiety and burn-out in adolescence.

There is a heightened media awareness suggesting parental pushing of sport on their children, as well as vicarious living through their children in non-sports activities such as glamour shows, national contests, and educational goals and scholarships.

Coaches, sports groups, and yes, sports medicine doctors, have made a business out of these often Type-A, intense, highly motivated, highly talented kids and their, at times, equally intense parents.

So what came first- the parent pushing their child into high-level sport or the child desiring the sport so much- they eventually became “premier” because of the hours of practice and dedication. Regardless, athletes spending time getting good at something have the risk of getting injured. Athletes in sports such as gymnastics, swimming, and dance can practice thirty to forty hours per week. Adolescent long distance runners can log fifty to sixty miles per week- running seven days a week and twelve months a year. Travel can involve weekend tournaments and even international competition. It may start as a sport but may become a career.

Studies suggest that the more hours you spend in one sport, the more likely you will have an injury. The American Academy of Pediatrics recommends a variety of activities rather than concentrating on one year round sport. This **cross-training approach** with several sports allows for recovery, less burn-out, and variety. Yet the American public enjoys seeing the Americans win at the Olympics (and gold-medalists likely didn’t have time to enjoy several sports), the American public enjoy hearing their city announced as the home town of the popular NFL quarterback (and with competition in high school today- the quarterback must be careful not to get injured in the off season while doing another sport such as wrestling), and the American public enjoys the idea of their child being the next prodigy of the sport their child loves, such as Tiger Woods did in golf.

**The American Academy of Pediatrics suggests children should be involved in more than one sport.** This cross training results in less burn out and less injury. Many sports medicine doctors say over 11 hours per week in one sport or 20 hours per week in two sports is the limit.

Premier level athletes and coaches will argue 11 hours per week may not be enough to excel ahead of the competitor and their desire is to be in the sport as much as possible.

A research example of why cross-training is important involves swimming. One study suggests there is an increased risk of osteoporosis and stress fractures in elite level, year round swimmers due to their bones not getting enough impact.

### **A true life example:**

It normally starts as a recreational activity. At six years old, a soccer team is put together with one of the fathers coaching. It becomes the school team with a uniform and a once a week practice in second grade. At this point, mob ball where the ball is hard to find amass the dozen kids tripping each other is played on a dusty field in the city park. Several of the team members learn in the next year or two that other activities are more fun. They change to swimming, arts and crafts, or video gaming! Several though eat, sleep, dream, and play soccer. These kids are asked to be on a more competitive team and at nine years old, they get a new uniform, a new coach, and two practices a week.

This **select** level of kids have really connected and not only do they play soccer, but they have sleep overs at each others homes and the talk at the dinner table is always about soccer team-mates.

By ten years old, your child has decided that soccer is the only thing that matters. You are not even sure it is a good idea. The **premier** team practices three times a week and tournaments are often two to three hours away. You have even asked your child if they would like to try another sport. You have asked your spouse if the Hawaii Classic is really in the budget. You have even questioned who started this soccer thing... was it you? Your spouse? The neighbor kid? It all is a blur but your child makes it obvious- there is nothing more important than soccer- not school, not even family- he has told you that the coach is as important as his parent, teacher, and religious provider. There is no one more powerful in his life- and when you think about it... the coach has been a good role model- so you see how the season goes.

With the amount of drugs, violence, and terrible things in society- your child is the lucky one to have a talent, a good role model, good friends who are also not in trouble, and a potential future in college. Soccer is healthy- better than video gaming- and has resulted in travel, friends, respect, and an incredible investment for your child.

All of a sudden you find yourself explaining the time and commitment your child and your family have made to the sport. It seems strange to the

neighbor possibly, but when the coach calls and asks for an emergency practice before leaving to Dallas- you don't even think twice. You throw the phone down, yell up to the second floor to get the soccer ball, and in the SUV you go- almost forgetting to open the garage door before backing up. Five minutes from kitchen phone to garage door- one minute faster than the last time the coach called in this situation. Even you are being trained for speed and agility! It's all part of being on the team! (Quick thought- who is it that is on the team?) The team depends on your child... it would be a disappointment if you were late- or heaven forbid not there at all. It is a commitment you have taught your child- your family- and yourself.

It began as recreational soccer- but now with your child identifying themselves as "a soccer player for the Premier's" and when the neighborhood conversation becomes "are you applying to colleges for soccer scholarships or for academic scholarships" and your answer is "both". The game is still just a game--- but now a little more. There is time, money, your child's goals... and even your goals to think about. And overall, it is a lot of fun! Even the rules make some sense now during the game, "HEY, that kid is off sides ref!"

Then, out of nowhere, there is the injury, the burnout, the grief of possible failure that must be addressed. Because every high level athlete is met with each at some point in their career. And for some athletes, it is a career ending injury, a mental burn out that just doesn't go away, or a missed opportunity that ends that scholarship or elite level dream. Premier level sport is incredibly rewarding and under the safety of supportive parents, there is an incredible life education as well as great fun, travel, friendship building, and respect for a sport. And who is to say which young athlete will make it all the way to his or her dream... the Olympics, KU Jayhawk Basketball, the New York Yankees Baseball Team? Some indeed will find different desires, different goals, and different non-athlete dreams- probably as rewarding in the long run as their initial Olympic dream. But an injury is a terrible way to end a chapter on a good season, or a good eight or more years in the sport.

**An injury is an unpleasant and unplanned event-  
and one that is out of control for the athlete**

something the athlete and parents aren't probably used to. And so the correct information as well as the most sports friendly information is what you and your child and your child's coach desires.

Regardless of the neighbor or teacher who can't understand why soccer is so important- you have lived an experience that can not be completely understood by the "normal" public. **And in a time of need, during an injury to your child- a simple- "just stop the sport for two weeks" is as if the doctor was not listening, not caring, and not understanding the last eight to ten years of your child's life.** By the way, the doctor was most likely listening- and may even have given the correct diagnosis and treatment- but unplanned injuries result

in unplanned visits to a doctor and typically result in unwanted, albeit, possibly necessary recommendations!

As for the quote, “No pain, no gain”... I’ll let you decide for yourself.

There is also a psychology in the young athlete’s thought process during an injury or illness. Let’s, for example, consider a sixteen year old elite level gymnast who has trained for eleven years and is currently on the national team- awaiting the chance to prove her desire to be on the Olympic team in the upcoming year. A recent pain in her ankle has been a bother during practice the last several days. Her coach is reluctant to make a big deal of it- as it may not only result in missed practice but a change in her incredible current confidence and unbeatable attitude. Finally, with a limp noticed during her run, the parents take her to the doctor. The x-ray shows nothing but the MRI obtained later that day reveals a stress fracture in the ankle- the talus- the bone just below the tibia leg bone. A discussion begins between the coach, parent, athlete, and doctor. To rest the ankle will result in a return to pain free activity and a normal run- but missing next week’s championship meet. To compete in next week’s meet without treatment could result in a worsened injury, poor scores, or a prolonged time of treatment needed with more pain. While the decision is being discussed- the athlete may be thinking-

“Twelve years of training coming down to this. I am not going to lose my dream because of a stress fracture.

The money, travel, and time that have gone into everything- I’m not going to disappoint my family because of this amount of pain- which I most likely can bear.

The expectations I have accomplished and the struggles I have overcome over the last several seasons- I can’t let this disappoint my coach.

The dances I’ve missed, the parties I couldn’t go to, the friends at school that identify me as “the gymnast”- I can’t have them see me less than perfect or lose this important designation.

My teammates that are fighting for the same dreams, the ones looking up at me for being on the national team, and the ones that have already been there that are cheering me on- I can’t disappoint them.”

Within minutes, a struggle of the realization that the athlete is not as capable while injured but unable to say “stop”. The coach does not want to miss the opportunity for an Olympic spot. The parents don’t want an injured child- but can’t comprehend stopping for something she may have had for days- even weeks- a stress fracture. Questions are asked such as- “what are the chances that this can get worse”, “will it cause permanent damage”, “can it cause another injury”- all good questions that the doctor just can’t answer for sure. But it would be nice for him to understand where everyone is coming from--- and where the athlete is trying to get to.

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Back to you reading this book- your child may not be an Olympic hopeful- yet. But the injury for your child causes the same emotions with each person. The high level young athlete does not want to disappoint their coach, parent, friends, team mates, or themselves. And a week into the injury, the athlete may seem dis-interested in the sport, some even wanting to quit. The sense of not accomplishing the season's goals may be more depressing than the actual injury that slowed them down.

**The time during injuries and illnesses are NOT a good time to stop the sport.**

If the athlete still wants to stop after a recovery from the injury or illness, then a meeting between the coach, athlete, and parent should take place... but as a general rule- the psychology of a high level athlete during an injury suggests it is not a good time for an end to their career- they just are not mentally as good at making decisions- already feeling self-disappointment, a sense that they have let people down (whether they have or not), and not being able to prove their potential because of something they can not control- an injury.

They are taught- whether consciously or sub-consciously- they are the best- they can win- they are a champion. An injury puts all that on hold- but does not mean they can't return to that attitude after recovery. Parents, coaches, and athletes should be told by medical providers that injuries can be tough- mentally and physically. Decisions on continuation and team placement should not be made by anyone until the athlete is treated. Everyone thinks more clearly at that time.

Most adversaries during sport are competitors, other teams, and visible problems that can, at least somewhat, be controlled by the athlete. Injuries are often "invisible", unexplainable, and out of the athlete's control- and therefore more frustrating than the season's worst loss or poorest performance. This "invisible" enemy can cause monumental disappointment, a lowered self esteem, fear of decreased skill and progression, and sometimes even clinical depression. While healing the physical injury or illness- don't forget to watch the athlete's attitude- it is sometimes much harder to heal!

## **Chapter 3:**

### **PAIN: Why you are probably reading this book**



## Chapter 3: PAIN: Why you are probably reading this book

The reason you most likely picked up this book was because your child was in pain.

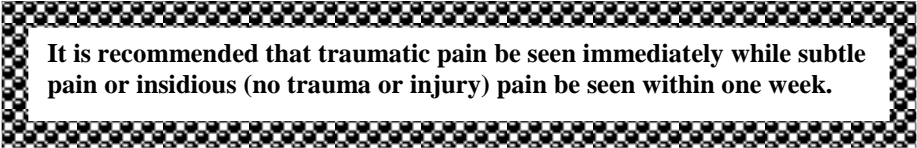
The number one thing to ask is

**-is this pain acute** (happened today, was a traumatic injury)  
:an ACL tear, a sprained ankle, a concussion

**OR**

**-is this pain chronic** (happened a few days ago, may have been insidious- no trauma but gradually came about)  
:A stress fracture, a growth plate injury, a hamstring tightness, anxiety, something not sports related at all.

Pain is typically the reason for a visit from an athlete to my office. In fact, swelling, bruising, and even abrasions can be missed by parents and coaches if the athlete doesn't bring it to your attention. But an athlete who limps, throws differently, or certainly if he or she complains of pain- must draw attention from coaches and parents. While "taking an ibuprofen" may be the exact right thing to do- not addressing the cause for the pain can result in worsening pain, a second injury from compensation, reduced speed and strength, unexpected poor performance during competition, and sometimes the end of a season.



**It is recommended that traumatic pain be seen immediately while subtle pain or insidious (no trauma or injury) pain be seen within one week.**

Those waiting longer than a week may only be prolonging needed treatment or therapy--- the sooner it is completed the sooner the athlete can return to 100%. Or, possibly reassurance and allowed continuation of play if the injury is found to be insignificant - and the confidence that nothing horrible is causing the pain will result in the athlete returning to play.

For instance- a stress fracture found and treated after one week of pain results in treatment of four to six weeks. If that same stress fracture is allowed to cause problems for two months (with reduced playing performance, increased complaints) it will still need the same amount of treatment but with the two months of reduced playing, reduced skill progression, and likely increased tension between the coach and athlete. Looking back- it would have been better to "catch it early" and get the treatment out of the way. If the last game of the season is tomorrow, it may be appropriate to wait until after the game. If national finals are



in six weeks, it would make sense to treat now and have an athlete at 100% rather than continue to decrease agility with an untreated injury.

**A sports friendly physician can diagnose after the first week of pain and then discuss treatment possibilities depending on the competition calendar.**

Most doctors will use a pain scale to help determine the amount of pain and disability the athlete has.

## **PAIN SCALE**

Interestingly, adolescent athletes typically won't "lie" or downgrade their number just to be able to play. This subjective number can be followed until it is a 3 or below- a number most physicians are comfortable having an athlete participate in their sport. Occasionally athletes will falsify their true amount of pain. Physicians experienced in sports care can often tell with special tests done during the exam. These are called malingering tests and although invented for patients who over dramatize their pain- or even make it up to miss work or school- in athlete's cases they can be used as clues for patients who under rate or try and hide their real pain.

Pain is subjective. One athlete may cry with a simple fall, while another may try and continue playing after breaking their arm. Pain can be strange as well. Stress and "adrenaline rush" may cover up pain from an athlete severely injured, while another athlete may complain of severe pain by just barely touching the skin due to a little understood problem called **Reflex Sympathetic Dystrophy (Complex Regional Pain Syndrome)**. In any case, pain is an important quality to help make decisions on treatment as well as continuing play. **And in every case, pain is real, should be believed, and must be carefully handled.**

### **RULE OF THUMB:**

**While some athletes are not willing to practice with any pain, some athletes try and work through severe pain that should be evaluated. A good rule of thumb is any pain lasting over one week, any limp, or any pain above a 3/10 should be evaluated by a physician before continued activity. And any joint with a limited range of motion or with swelling should be evaluated.**

### **Questions to ask your doctor**

Along with the questions you may already have for your doctor, this dark box may suggest other questions to ask your doctor.

Be prepared and be an advocate for your child.

Each athlete will be slightly different and this is completely subjective. Pain is real and must be believed, even if it is completely different for each athlete

- 0-** No pain
- 1-2** Minimal Pain, lasts moments, typically missed by parent or coach even when they ask the athlete
- 3-4** Mild Pain, typically dull, may come and go, Athlete may ask for medicine and alert parent/coach
- 5-7** Moderate Pain, typically can point to one location where pain is “bad”, typically noticed by coach or parent, athlete may limp if pain is in the lower extremity
- 8-9** May follow a traumatic event, sharp pain, a stoic athlete may even cry
- 10** Most athletes won’t use this number, even in the most traumatic situations, explained as a “bullet wound” type pain- and although most people have not experienced a bullet wound, they appear to understand the significance of a “10 out of 10” pain. Examples of adults stating their 10/10 pain was a torn Achilles tendon, passing a kidney stone, or a fractured pelvis in a car wreck.

## What about medication?

While non-steroidals (NSAIDS) like ibuprofen and naproxen have a huge market in injury care, pediatricians recently have become more cautious with their use. General pediatricians have always been careful with covering up symptoms with medication and a concerned doctor may miss something by treating the symptom of pain rather than fixing the actual problem. Sports medicine orthopods and primary care doctors have recently also begun using non steroidal medicines less often. There are concerns that non-steroidals may influence already existing cardiac problems, increase the risk of stomach ulcers, can increase wheezing in asthmatics, and can cause kidney damage- as well as some research suggesting NSAIDs delay normal bone healing after a fracture. The newer Cox II inhibitors, while safer on the stomach, are still in the media due to their cardiac risks (Rofecoxib (Vioxx) was even taken off the market for this reason). Narcotics are almost exclusively reserved for severe pain due to traumas and post operative pain. Gabapentin (Neurontin) is in the seizure class of medicines used for chronic pain and reflex sympathetic dystrophy (Complex regional pain syndrome). Muscle relaxers are questionably helpful and may be used in short courses in older adolescent athletes and adults.

Non-steroidal medicines have the most use in sports medicine and are helpful in short courses such as two to five days recovering from mild injury. Longer courses should be addressed by a physician. Some athletes use NSAIDS regularly, almost as a ritual. This can be very dangerous, leading to acute and chronic injury to the stomach, intestines, and kidneys.

*While pain is anxiety causing to parents, coaches, and athletes, it is also the trigger that tells everyone something is wrong and may be reducing an athlete’s progress.* A runner with shin splints may be able to continue practice but an increase in pain at one spot on the shin could be a stress fracture. This change in pain may explain reduced times, a flattened attitude in practice, and even a change in behavior at home or school.

**Athletes at the premier level CAN get depressed by the thought of an injury slowing them down,** resulting in missed competition, and in the back of their mind is always the thought- “will I have to quit?” Sometimes the reassurance of a length of time before improvement, or an actual diagnosis is helpful in reversing the down hill slide in attitude and the hopeful return of the body to normal.

While medication is often helpful- typically with sports injuries- the real focus should be placed on fixing the problem. The next several chapters will describe the most common adolescent sports injuries, separated by anatomy.

**Remember, there is nothing more important than a medical professional actually hearing the story, and determining the best treatment by a physical exam. This book will help you through the decision making- but can not replace the physician exam, thought process, and treatment plans.**

**Medications typically used in Sports Medicine**

- Nonsteroidal anti-inflammatory
  - Ibuprofen- Motrin, Advil
  - Naproxen- Aleve, Naprosyn
  - Ketoprofen- Orudis, now typically only used in topical form
  - Cox II Inhibitors- Celoxicob- Celebryx
- Narcotics- Codeine, hydrocodone, oxycodone
- Other- Gabapentin (Neurontin) and others for RSD (CRPS) and chronic pain
- Muscle Relaxants for treatment of muscle spasm

**What is Complex Regional Pain Syndrome:** Once called RSD (reflex sympathetic dystrophy), this bizarre problem results in pain more intense than expected for the athlete’s diagnosed problem. Causes include an injury, surgery, prolonged immobilization such as casting, or for a completely unknown cause. The nervous system, for some reason, decides that the involved limb is reporting pain and changes in temperature and sensation. This pain must be “reset”. Occasionally MRI reveals hints of CRPS with scattered bone marrow edema, but often all tests are normal. Usually it occurs in the arm or leg, and it is more common in females. A cold, blue, painful extremity that the patient doesn’t want to touch or have anything touch it (like socks or sheets on the bed) is a clue for this difficult to treat problem. Medications such as gabapentin (Neurontin), sympathetic nerve block injections, psychologists, and most importantly, physical therapy are required for success. A slow, sometimes painful, road back to a pain free life, and sport, requires patience by all involved, the parents, coaches, doctors, therapists, and athlete.

# The Sports Physical

The sports physical is a requirement before school age sports, but often not required for premier and club sport until the national and international level.

Sports physicals were initially done to ensure that growing children were safe to compete against one another. A thirteen year old football team could easily have a boy who was seventy pounds and had not started puberty playing with the same aged boy who was well into puberty and over one hundred and fifty pounds. A tackle from the larger boy could significantly injure the smaller one. Today, less significance seems to be placed on this idea while more significance is placed on the individual's health history.

The history should be reviewed including medications possibly needed on the field such as albuterol for the asthmatic and a sugar supplement for the diabetic who may become hypoglycemic. Medical history including surgeries and number of concussions can alter the recommendations for type of sports allowed. Symptoms such as headache, dizziness, vomiting, or chest pain during activity can also interest a physician to further examine a problem.

Family history may be the most essential piece of the history to discuss. A family member who died from heart disease before the age of fifty years old places a heightened risk for the athlete. A cardiac workup including chest x-ray, ECG, and echocardiogram might be considered. Some countries, like Italy, carefully examine all athletes' hearts before competition. The US has such a high number of young athletes resulting in increased resources and expenses- echocardiograms are reserved for only those believed to be at risk. Private companies offer these studies for those families and teams with interest.

During the physical; blood pressure, body mass index, visual acuity, and obvious orthopedic problems are normally addressed. Just as important, but sometimes less focused on is the abdominal exam (checking for liver and spleen organ size), genital exam (checking for hernias), and heart exam (checking for murmurs or irregular rhythms).

The sports physical is a controversial necessity before sport. Some insurance companies are unwilling to pay for this "elective" meeting with the doctor. Private clubs such as soccer and gymnastics teams often require no release from a doctor. The American Academy of Pediatrics continues to support the pre-participation sports exam. There are obvious good and not so good things about it.

**Here is my perspective.**

**The good:**

Often adolescents don't see their doctor unless they are sick. This is an opportunity for relatively healthy children (athletes) to have their blood pressure taken, questions about their healthcare answered, information offered by a reputable resource on items such as nutrition, social interactions, puberty, sex education, the harms of illicit drugs and safety/risk of supplements, as well as the opportunity to have a physical exam to pick up a possibly missed problem.

**Discuss Medications:**

The International Olympic Committee rules of banned substances, antibiotics, over the counter dangers, herbs and minerals, illegal medicines such as steroids, and legal but questionable medicines such as creatine and supplements may be discussed with a doctor- a more reliable resource than their friends or the salesmen of the supplements.

**The not so good:**

The exam is truly a screening rather than a complete physical. There is rarely blood work to check cholesterol, vitamin D, or hemoglobin for instance. There is, in this country, almost never a full cardiac workup (and rarely is it necessary). It is possible to go to an excellent physician and still have something missed- even something as notable as a cardiac abnormality.

Some sports physicals are done in a group setting with the entire team. The history is written rather than discussed. The physical is brief and only the most obvious abnormalities are caught. It is less expensive, takes care of the paperwork, and pleases the coach to have the team "done" in one day- but offers very little medical benefit- except in the most glaring abnormalities.

Still, I believe the contact with a medical provider, and the possibility of picking up a child in need of eye glasses for poor visual acuity, or blood pressure medication for "silent hypertension" makes the pre-participation screening worthwhile- not perfect, but none-the-less worthwhile.

In the future, a sports physical exam may include a history, physical exam, cholesterol and vitamin D laboratory screening, cardiac screening with EKG and echocardiogram, a computer test to get a baseline of cognitive function in case the athlete gets a concussion the next season, vital signs, vision screening, flexibility and balance testing to offer preventative exercises predicting risk before an injury occurs... now that would be a sports physical!

# The Sprain- A Common Diagnosis Defined

## What is a Sprain, What is a Strain?

A strain is commonly thought of as a muscle pull or an injury to its tendon- the connective tissue from muscle connecting to bone. A sprain is an injury to a ligament- the connective tissue between two bones. In all cases- they are graded from a 1 to 3.

### What is Grade I, II, III?

Most doctors think of grading this way:

**Grade I-** a pulling on the muscle, tendon or ligament causing inflammation, swelling, and pain. Ice, anti-inflammatory medication, and relative rest will typically be enough. There may be some mild weakness, but the muscles and tendon/ligament structures still work correctly.

**Grade II-** a more severe stretching with some tearing but not completely separating the soft tissue. More obvious weakness and the patient limps if it occurs in the lower extremity. Physical therapy is generally indicated for strengthening, and proprioception. Proprioception is “muscle memory” or the ability of the muscle and nerve “firing” so that the muscle works correctly.

**Grade III-** a complete tear of the muscle, tendon or ligament. The muscle/tendon complex may not work at all. While physical therapy is often tried, surgery may be necessary for healing of the injured area as in an Achilles tendon rupture.

Patients often get very excited about the diagnosis and demand the grade of injury from their doctor. It is a continuum. Some injuries may seem like Grade II and actually be a Grade I, while another doctor may think opposite. As long as the patient gets the proper care for quick healing- in most cases the Grade really doesn't matter.

### There are some exceptions:

1. Achilles tendon complete disruptions (grade III) require surgery quickly without a physical therapy trial.
2. Complete disruptions of ankle ligaments (grade III) may require surgery (although often immobilization and physical therapy are tried first)
3. In the knee, an ACL sprain requires rest and physical therapy in most cases while an ACL tear requires surgery if a sport is to be continued.

The grade is simply a way for the doctor to decide how aggressive of treatment is necessary and a way to communicate with other medical providers such as physical therapists and surgeons.

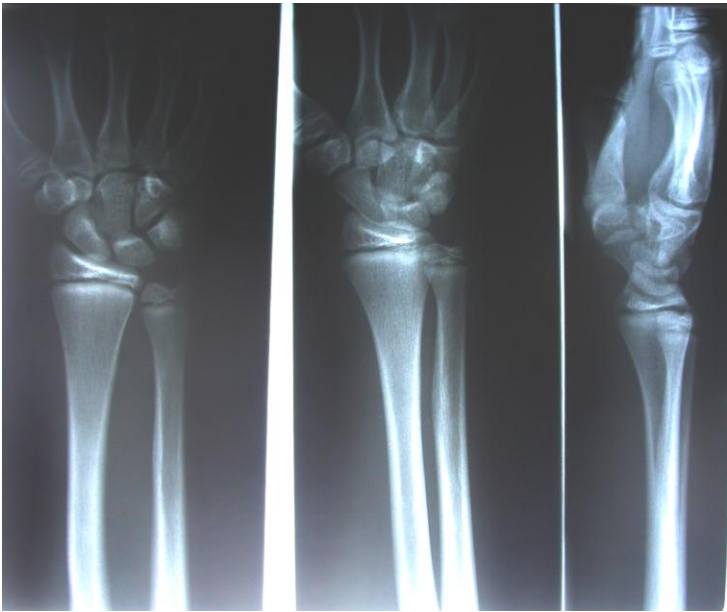
**Grade I- NO TEAR**, likely rest with a quick return to sport- in several days. No immobilization usually necessary.

**Grade II- PARTIAL TEAR**, more rest needed, and physical therapy likely to help with strengthening, pain relief, and proprioception, immobilization may or may not be needed according to pain and swelling

**Grade III- COMPLETE TEAR**, immobilization may be necessary and possibly more studies to consider a surgical benefit.

## Chapter 4 :

# A Course in Radiology





# Chapter 4: A Course in Radiology

Sports Medicine depends on several things. One of the most important is fast, efficient, and accurate diagnosing of an injury. If the competition is one week away, athletes just don't have two weeks to see if an injury will get better on its own. Often, two weeks is just enough time to treat something in anticipation for participation in the next tournament. And waiting two weeks- without pain relief- may result in missing the competition all together.

Thus a radiologic exam may show no injury- but be important giving permission for the athlete to push forward with physical therapy, hoping for a quicker return than rest alone. Or the same exam may show a torn ligament requiring surgery- that can take place that week rather than learning about it two weeks later- after things were not improving. Waiting two weeks does save money and radiation- two important factors to consider- but "wastes" time that may ultimately be important in the competition schedule. Decisions must be made prioritizing the injury with the athlete's schedule and season's goals.

So here is a brief explanation of techniques in radiology commonly used in diagnosing injuries- possibly the most important tool next to the physical exam by your physician.

### X-ray (often called plain films):

<u>X-ray</u>	
<b>GOOD</b>	<b>BAD</b>
X-ray machines are in almost every office	Not every office has skilled technologists taking the x-ray
X-rays are fast, inexpensive, and every doctor has seen them (at least in medical school!)	Difficult to see stress fractures
X-rays have a very low amount of radiation	Can't see everything "inside the bone" so things can be missed
Best for trauma, acute injury, fractures	

X-ray has been used for years. It is inexpensive, easy to obtain, relatively easy to interpret, relatively safe to have, and by far the most common radiology test in any sports medicine practice. My feeling is, it is never wrong to get an x-ray- it may not be necessary, but it is rarely a mistake. People often say, "is it broken?" The x-ray is the fastest way to obtain that answer.

**RULE OF THUMB:**  
Some people want to know if the doctor says it isn't broken, could it be fractured?

**Fractured and broken defines the same problem. If the doctor says it isn't broken... then it also isn't fractured!**

## CT: Cat scan

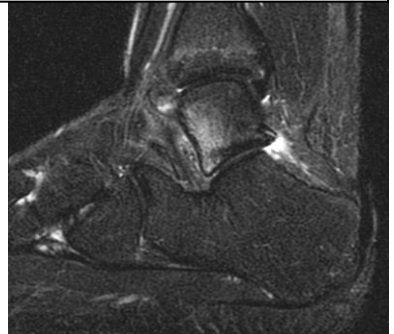
<u>CT Scan</u>	
Good	Bad
Can see “inside the bone”	Radiation is higher than x-ray, the AAP states doctors should do fewer CT Studies.
Excellent at imaging sinuses, appendix, Acute trauma to brain, bone disease reading it	More skill needed for doctor
Fast (takes 10-20 minutes)	More expensive than x-ray, need to schedule, isn't in every office

This is a definite upgrade from plain films. The CT scan is great for several things. Although higher in radiation than plain film- it remains a safe method of evaluating injury. It is a bit more expensive but is still in every hospital and several outpatient radiology centers. It is suggested as standard of care for looking for blood in the brain after a head injury if deemed necessary by an emergency room doctor. It is useful for finding infections such as sinusitis, and helpful in finding bony injuries such as spondylolysis (stress fracture) in the back and scaphoid injuries in the wrist. Newer technology has allowed for 3D reconstruction making amazing life-like images of bones- important for surgeons for surgery and for radiologists to better visualize fractures.

## MRI:

<u>MRI</u>	
Good	Bad
Can see soft tissue such as muscle, tendon ligament, bone marrow, not as good at seeing bone as a CT scan	Expensive, fewer machines
No radiation	Takes skill to read results
Great for stress fractures, knee imaging, brain	Test takes a longer time (30+ min)
	Could be a problem if patient is claustrophobic, has metal in body, won't sit still (young kids)

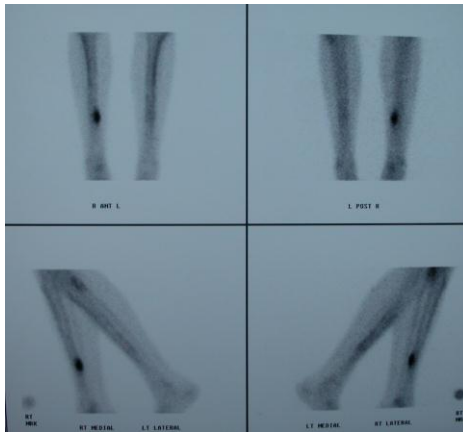
Relatively new in the medicine world, MRI has saved the day for doctors and patients. While patients used to endure surgery just to find the diagnosis, MRI can explore the injury without a single cut! This method is far better at looking at soft tissue such as ligaments, tendons, and muscle than CT scans or x-rays. As technology improves, MRI can detect stress fractures, changes in the bone marrow, tumors,



and even vascular diseases. Functional MRI is being researched for concussion diagnosis. It is more expensive than x-ray or CT scan and there are relatively fewer machines- **but there is no radiation exposure**- as a magnet is involved in imaging- not radiation. It is the standard method of evaluating knee trauma and often the next test if an x-ray is unhelpful in finding the answer.

**Bone Scan:**

<u>Bone scan</u>	
<b>Good</b>	<b>Bad</b>
Can see the whole body in one test	Contrast, requires an IV and three hours of wait time
Highly sensitive in picking up any bone activity such as stress fx or tumor	Is not specific- areas of intensity do not tell what it is, just that activity is present



There are good uses for bone scan- although they are sometimes (but not always) unfavorable for children. Let’s discuss how it is done. An IV must be placed and IV contrast injected into the patient. Three hours of wait time before multiple radiographic images are taken. The contrast is picked up by bone that is active- either because of injury, tumor, or healing. The activity is seen by the radiologist as “dark spots” on an otherwise white outline of the patient’s skeleton. These dark spots (“hot spots”) appear with even the smallest amount of activity, but do not specify why the activity is there. This activity could be from stress fracture, tumor, or infection. The history is important in deciding why there is activity as each creates a similar picture to the radiologist. Thus it is extremely sensitive (picking up even the smallest amount of activity) but not at all specific (the test does not separate fracture from tumor or infection). I believe in sports medicine, it is best

utilized to rule out stress fractures in the back, spondylolysis, or in the leg, helping to decide between a stress fracture and shin splints.

Before MRI was affordable and easy to schedule- bone scans were invaluable. Now, with the relative ease of MRI- I choose MRI over bone scans in most instances. Most children dread IV's, while I attempt to, when I can, avoid contrast and radiation- both done with bone scans. The whole body is seen with a bone scan while an MRI you must specify one area of the body. I typically am not interested in the whole body anyway (although a cancer doctor would be interested in a whole body scan to see if a bone tumor had spread for instance). Often a positive bone scan leads the radiologist to recommend an MRI for more specific information anyway. The MRI shows much more clarity of the site and what might be causing the bone activity.

Still, many doctors do prefer bone scans along with SPECT scans, and ultimately, they will give you valuable information. In fact, some doctors would argue it is as good or better than MRI for some diagnosis such as stress fractures in the back (spondylolysis) or in the wrist (gymnast's wrist). If I can get it- I prefer MRI over bone scan in almost every case (except spondylolysis possibly where bone scan or CT scan are preferred). And once a plain x-ray is done and more information is needed for the ankle, foot, shoulder, knee, and neck/back- I don't think any doctor would disagree that the MRI is valuable if more information is needed.

**Bone Density / DEXA:**

<u>Bone density- DEXA scan</u>	
<b>Good</b>	<b>Bad</b>
Important to get measurements to check osteoporosis- initially for older women	Fewer standards for kids on what is normal
Minimal radiation	
I recommend a DEXA for baseline results for athletes who have had over one stress fracture in their career, or a fracture where the mechanism of injury was not "expected to cause a fracture"- yearly scans may be necessary for serial follow up.	

## Ultrasound:

<b>Good</b>	<b><u>Ultrasound</u></b>	<b>Bad</b>
Accessible, fast, inexpensive		Difficult to read unless you are a radiologist
No radiation, extremely safe		Not great for bone injury, rather it is used in abdominal problems such as kidney disease, “ok” at looking for appendicitis
Can see intra-uterine infant		or OBGYN problems such as ovarian cysts
Good for picking up fluid, cysts		

### **Questions to ask your doctor**

X-ray is almost always done first- even if ultimately an MRI or other test is eventually needed. The x-ray is inexpensive and if it answers the question- easiest to do.

1. If the x-ray doesn't help us with the diagnosis- how long will you wait before the next test, ie. MRI, CT scan, etc?
2. If you are planning to order an MRI, are you having us go to an open or closed MRI? Open has less problems with kids that are claustrophobic but closed MRIs offer more crisp images and often are preferred by orthopedic surgeons.
3. Who reads the x-ray, a general radiologist, a radiologist with orthopedic interest, an orthopedic surgeon, the doctor you are seeing? The more doctors looking at the results, the less chance something will be missed. Sometimes the MRI reveals the problem- but the reader of the MRI misses it- only to be picked up by another doctor reviewing the images.

There is no correct answer... every situation will be different, but your doctor's answers should make sense according to your child's problem, level of sport, and upcoming expectations.

# “The Race”



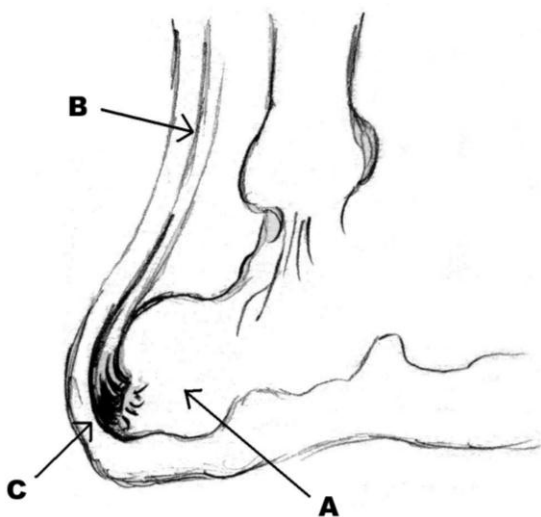
**This text is NOT an authoritative medical resource. It is intended to offer accurate information for parents and coaches to better understand several sports medicine topics and increase their knowledge to better communicate with their health care provider. The information is NOT exhaustive and may change as new information is learned or researched.**

# Orthopedic Issues in Sport

## Heel Pain

In adolescence the heel or (A) calcaneus, is an active site for growth. It is also an area that is constantly being stressed by the athlete. Between growth and pounding exercise- heel pain is very common.

First, the Achilles tendon (B) inserts into the heel (A). During a growth spurt, the bones get longer while the tendons and ligaments attempt to stay the same length. This causes them to stretch and pull, resisting the active bone growth.



Along with bone growth, adolescents often have a relative asymmetry of muscle mass. While never equal, it is best to have opposing muscles balanced in their strength. The calf muscles should be as strong as the muscles on the shin, just as the bicep muscles should be as strong as the tricep muscles in the arm. Depending on the sport, athletes may over emphasize one group of muscles, leading to an imbalance and resulting in asymmetric pulling on ligaments and tendons. This growth and relative asymmetry results in inappropriate tensions leading to inflammation and pain.

Finally, constant pounding on soft, growing bone with open growth plates (C) can cause fluid to accumulate. This also is painful. And if the fluid is seen in the bone (MRI), careful consideration should be made if a stress fracture is present. More on this later.

### **Heel Pain- Common in Adolescents**

Achilles tendonitis  
Sever's (Calcaneal Apophysitis)  
Stress fracture vs. bone bruise

### **How the Doctor will Diagnose:**

History and Physical exam  
\*X-ray  
\*Bone scan or MRI  
\*Not always needed

The history is essential. Heel pain in an eight year old is completely different than that in a twenty year old. And pain starting after a fall is completely different than that occurring gradually over two to three weeks without a trauma.

### **Warning Signs**

Fever  
Pain awakening child at night  
Limp  
Pain in other areas of the body  
Rash, bruise, lesion

### **Prevention**

Good cushion in shoes  
Cleats with caution  
Heel cup  
Achilles stretching  
Good running technique

### **Heel Pain- Uncommon in adolescents**

Infection- osteomyelitis  
Tumor- Benign and malignant  
Foreign Body- glass, wood, metal  
Plantar fasciitis

### **Heel Pain- In adults and RARE in children**

Bone spur- typically doesn't cause pain  
Achilles Rupture- uncommon in children  
Bursitis and Arthritis- more common in adults

### **Rule of Thumb**

**Kids don't normally limp.  
If a child limps, a medical evaluation is absolutely necessary.**



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### **Case #1- Sever's Syndrome-**

A ten year old male soccer player typically plays defense. In the past two weeks though, he has been moved by his coach to a mid-field position. He therefore has been running more. He complains that his right heel is hurting and points to area "C" (page 47). He has had no injury, no trauma (or foreign body through the shoe), has not been ill, and is not limping.

This is a classic case and most likely Sever's. Due to the increase of running, his Achilles and ankle are working harder. This stretching may even be pulling at the insertion of the Achilles to the heel and this is called apophysitis (inflammation at the apophysis). The heel is also called the calcaneus and therefore the official term for Sever's is calcaneal apophysitis. This same mechanism of injury can occur at the knee (osgood schlatter), the elbow, and other areas of the body. X-rays at the heel are normal and might be taken to rule out more ominous problems. Treatment involves ice bucket therapy (bucket filled with 1/2 ice and 1/2 water) rather than ice pack, aggressive Achilles stretching, heel cup protection, and good running technique. Athletes will improve with rest; it is unlikely that Sever's will actually worsen with activity (although the heel will hurt more because the Achilles is stretching with activity, but it will likely not anatomically worsen). Athletes typically rate Sever's a 3-6 out of 10 on a subjective pain scale although it can get to an 8 or 9 out of 10 in some cases. Normally, athletes are asked to stop exercise if limping or if they have pain exceeding a 3 or 4 out of 10 on their pain scale.

#### **Treatment Strategies for Sever's** see page 7 for explanation

Medicine - 3: ibuprofen and topical pain medicines have worked with some success

Physical Therapy- 3: heel cup, stretching Achilles, ice

Acupuncture, Reflexology, Biofeedback, Manipulation, Craniosacral: 2

Surgery- 0: not necessary

Complete rest or booting/casting- 4: will greatly reduce pain, although the problem will likely not to go away until growth ended. While recreational/select athletes may take a break, often premier/elite athletes continue practice with some pain.

### **Most common advice for Sever's**

Ice bucket after activity- bucket 1/2 filled with ice and 1/2 filled with water, immerse heel for 5-10 minutes (it's COLD!)

Heel protection with gel heel insert into shoe, sports not wearing shoes can consider a sock with the heel cup glued inside (there are several companies making this product such as Tuli's Cheetah™, and Sole Impact™)

Achilles Stretching before exercise

¼ inch heel lift to relax the Achilles during activity (typically a gel heel insert is enough), too much of a lift will make things worse

Night splints for Achilles stretching are occasionally used

While rest will relieve the pain, exercise probably won't make Sever's worse, but there may be pain because of Achilles inflammation!

Rarely, a cam walker may be used for complete heel rest, but the pain may recur when the boot is removed and activity is restarted.

### **Case #2: A stress fracture**

A twelve year old gymnast complains of 4-5/10 heel pain for three weeks. Running is the most painful activity and the coach recalls seeing her limp once or twice in the last week. There has been no fever, night awakening, or known injury.

This three week time period demands a physician do a physical exam and most likely an x-ray as well. Although the x-ray is appropriate, honestly, it rarely finds the diagnosis. The facts that there has been a limp (even if just intermittent) and a three week history- think stress fracture! It could also be Sever's. The incidence of stress fractures in young premier level athletes is increasing. Possibly because we are better at finding the cause of pain (MRI) so we are now diagnosing pain that before we didn't realize what it was- or we are demanding an increased level of skill from young athletes thus more athletes are getting injured. In any case- stress fractures are common... and commonly overlooked. They are difficult, in some cases impossible, to see on a plain x-ray. While bone scans will detect them, MRIs have become the popular diagnostic test. Ten years ago, while too expensive, and too difficult to find an accessible unit- today the cost has come down, and there seems to be an MRI at every hospital, clinic, and corner store. See the radiology chapter to decide which is best in your opinion.

However found, a stress fracture should be treated. If it isn't, it will take weeks longer to relieve the pain, and weeks longer of poor practice, and decreased performance during competition. This is a diagnosis where you should think of

treating it as soon as it is found... and something you should think about diagnosing sooner than later. Stress fractures, with no exercise, will probably go away. Stress fractures with continued exercise will become a chronic, painful nuisance- that decreases activity, performance, and eventually the mental competitive edge.

Children not in high level sport probably don't need special treatment for most stress fractures, as they will heal with rest alone- although children not in competitive sport are unlikely to do something causing a stress fracture in the first place!

And children in competitive sport typically need "forced rest" such as a cam walker or cast, as the stress fracture won't resolve with continued impact and use.

Typically a cam-walker boot is an appropriate protection and your doctor can assist you in deciding on the length of time- somewhere between 3-5 weeks is typical. Make sure to read the chapter on "Proprioception: What to do after casting/booting/and taking time off". If there are two stress fractures in a child's career, I recommend a bone density DEXA scan to get baseline information looking for weak bones (osteomalacia and osteopenia) that can lead to osteoporosis. Blood work and other testing is not required in every case but can be discussed (calcium, thyroid levels, hormone levels, vitamin D level, genetic testing).

The bottom line is non-athletes probably are not diagnosed with stress fractures because they heal on their own with non-activity. And athletes need to be considered for a stress fracture if they have chronic pain (with or without a recalled injury) as not treating one will result in poor performance and lingering pain.

## **Case I compared to Case II**

Does Case I and Case II sound similar? It can be tough and things do overlap in medicine. An MRI can be helpful as the stress fracture will have fluid in the bone, while Sever's will look more normal. Not everyone with Sever's needs an MRI though. Typically, Sever's is so classic, a physician comfortable with pediatrics, orthopedics, or sports medicine can make this decision in the office without expensive tests.

Incidentally, a stress fracture can hurt so little that it is missed and "written off" as a bruise during a couple of weeks of pain. And Sever's can get so bad that the child limps and can not play sport at a competitive level. In fact, Sever's can require a cam-walker boot to allow the inflammation and pain to subside- this

almost completely removes the athlete from sport- and thankfully is rarely required.

If Sever's is not treated, it eventually will get better, while a stress fracture may not until it is adequately rested and allowed to heal. Therefore determining one from the other is essential and sometimes the MRI is the determining factor for diagnosis.

### **Treatment Strategies for Calcaneal Stress Fracture**

See page 7 for explanation

Medicine- 3: ibuprofen and topical medicines have helped with pain

Physical Therapy- 3: heel cup, ice

Acupuncture, Reflexology, Biofeedback, Manipulation, Craniosacral, 0

Surgery-0: not necessary

Cam walker or casting- 5 This is the treatment of choice. I prefer a cam walker because they can be removed for showering and can be walked on; while casting requires 24 hour wear and crutches usually. If the athlete is non-compliant though (if they are going to cheat!) then a cast may be needed to ensure treatment.

### **Case III: Plantar Fasciitis:**

A seventeen year old long distance runner complains of one week of lower heel and foot pain after increasing his distance from 10 to 13 miles. It is a 6/10 pain and worse after the first mile of running, in fact he can't finish his work out.

The area of this athlete's pain along with the story of increased mileage goes along with **plantar fasciitis**. This condition can be extremely painful, cause a limp, and often takes convincing the athlete there is nothing more injured. The fascia is the connective tissue at the bottom of the foot and connects to the heel. Pushing on the area can cause stabbing pain and is typically all that is needed to prove the diagnosis.

In adults, steroid injections are often offered. This is a much less accepted practice in the growing adolescent. Instead, ice bucket immersion, stretching, and good shoe wear is recommended.

Shoes should be changed every 300-400 miles AND every 6 months regardless of mileage. The sole of a good running shoe eventually wears down and even a \$150 shoe sitting in the closet will not be as safe as a newer \$70 one. Sports requiring cleats (especially shoes with different sized cleats on the border compared to those in the center) cause additional problems as well as athletes that run flat footed rather than heel to toe.

Indeed this is a condition that sometimes requires rest, but usually can be managed with aggressive therapy- especially if during the season.

### **Treatment Strategies for Plantar Fasciitis**

See page 7 for explanation

Medicine - 3: ibuprofen and topical medicines have helped with pain

Steroid Injections - 1, not recommended during adolescence

Physical Therapy - 3: heel cup, ice bucket, stretching, watch running technique, check shoes

Acupuncture, Reflexology, Biofeedback, Manipulation Craniosacral - 3 helps in some instances

Surgery - 0: not necessary

Cam walker, casting, or complete rest- 4, rarely necessary though

**Case IV: Achilles tendonitis:** A sixteen year old dancer complains of pain behind the heel. Relieve painful, while walking is not. The pain approaches a 4/10.

**Achilles Tendonitis** can be a nuisance. In adults, it can even tear- which is very painful- possibly 10/10 pain! It is less common for adolescents' Achilles to completely tear, but not impossible. If a complete tear occurs, surgery must take place in the next several days and not later than two weeks.

Normally though, Achilles tendonitis occurs because of over training, poor technique, or inadequate stretching and conditioning.

The exam is typically classic and rarely other tests are required to prove the diagnosis. One potentially overlooked diagnosis (unless an x-ray is ordered) is an os trigonum. This accessory area of bone can fracture from the posterior talus causing pain and sometimes irritation around the Achilles- mimicking Achilles tendonitis. It occurs after impingement from excessive plantar flexion such as being "on toe" in ballet, or accidentally kicking the ground while attempting to kick a soccer ball. An Achilles tendonitis diagnosis that doesn't resolve with typical treatment may actually be chronic pain from an os trigonum which is initially treated with rest- but sometimes requires surgical removal.

### **Treatment Strategies for Achilles tendonitis**

See page 7 for explanation

Medicine- 3: ibuprofen and topical medicines have helped with pain

Physical Therapy- 4/5: heel cup, ice, stretching

Acupuncture, Reflexology, Biofeedback, Manipulation Craniosacral, 2/3

Surgery-0: not necessary unless torn completely

Cam walker, casting, or complete rest- 4 although rarely necessary

Check shoes, training technique, and possibility of over training.

The heel is in constant use and so when hurting, can result in an athlete in constant pain. In the young adolescent (7-11 years old, Sever's is common) while in the older adolescent (11-18) stress fractures should be considered. Sever's never occurs in adults (the growth plates are closed) while stress fractures may occur at any age, but much less commonly before age 7. Stress fractures should be treated with immobilization sooner than later, while Sever's may require immobilization but typically require only an altered workout- **relative restriction**- until pain subsides. And yes, both can recur- Sever's commonly comes and goes- growth spurts can alter the pain, while stress fractures hopefully do not recur. If a stress fracture does recur- at any location- consider the cause to be over training, poor technique, and possibly poor nutrition. See the stress fracture chapter for more information.

Plantar fasciitis and Achilles tendonitis are soft tissue injuries where altered workouts – **relative restriction**- will normally be all that is necessary to lessen the pain and return the athlete to normal level.

Other diagnosis may be considered by your medical provider but are far less common in a typical sports practice.

### Questions to ask your doctor

1. How long do you predict this pain will keep my child from being 100% if we completely stop activity?
2. How long do you predict this pain will keep my child from being 100% if physical therapy is done?
3. How long do you predict this pain would last if we continued to not treat it, but possibly use a heel cup or stretch?

Time predictions are not 100% accurate. It is nice though to have a time line to follow with your doctor.

If things go better than planned, everyone will be happy.

If things take longer, it gives both the doctor and the athlete the hint that a second opinion or possibly a different approach may be necessary.

It is easiest to establish this at the very beginning- with adjustments possible along the way- if there are unforeseen setbacks. That way, you, your child, and your doctor will understand the importance of the treatment, the expected time away from practice, and the scheduled goal of return.

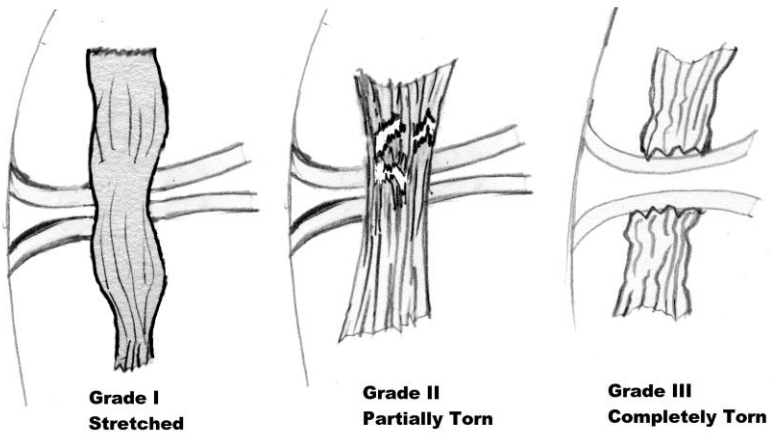
On the other hand, when there is no time line established- the doctor may believe six weeks off is reasonable and the patient may have the understanding that only two weeks of rest is necessary. This may cause unreasonable expectations, anxiety with progress, and dissatisfaction from both the doctor and patient.

# Foot and Ankle Conditions

In almost every sport, with the exception of swimming, the foot and ankle take the majority of impact and trauma during practice and competition. While shoe wear is important, some athletes have even more trauma because they don't wear shoes, such as gymnasts, martial arts, and dance.

This chapter focuses on the most common problems seen in the foot and ankle in adolescent sport. As in the rest of the book, this is not an exhaustive list.

**Ankle sprains**- The most common sports injury, an ankle sprain, is diagnosed in every medical office. Emergency rooms, family practice, orthopedics, and yes, even the school nurse's office. While it is a painful nuisance, **it is also often over treated.** First, let's review the anatomy. The outside of the ankle (lateral) is made up of primarily three ligaments (soft tissues connecting bone). The first is the anterior talofibular ligament which is the most commonly injured. The calcaneofibular ligament and posterior talofibular ligaments are less often injured.



Most physicians classify a first degree sprain as a stretching of a ligament (1). A second degree sprain is a partial tearing (2), and a third degree sprain is a complete tear (3). While all three are painful, it is only the third degree sprain that results in prolonged missed practice and need for immobilization. The first and second degree sprains recover more quickly with activity, physical therapy, and **relative restriction**, not complete rest.

In diagnosing an ankle sprain, a medical provider may do a series of physical exam tests such as tilting the ankle, pushing on landmarks, and checking

for bruising and swelling. Functional tests are important as well- such as the athlete's range of motion, degree of pain, and ability to walk, balance on the injured foot, and run.

X-rays are important to find fractures but never show ligament injury- except for swelling. An MRI shows ligament injury but is rarely necessary. In fact, an ankle sprain is one sports injury that imaging is not very useful. The Ottawa Ankle Rules were put into place to assist fiscally managed emergency room doctors in Canada in deciding if an x-ray is needed to check for a fracture. While it is useful for adults, it is less useful for adolescents with open growth plates.

**Ottawa Ankle Rules**

You don't need an ankle x-ray when you have

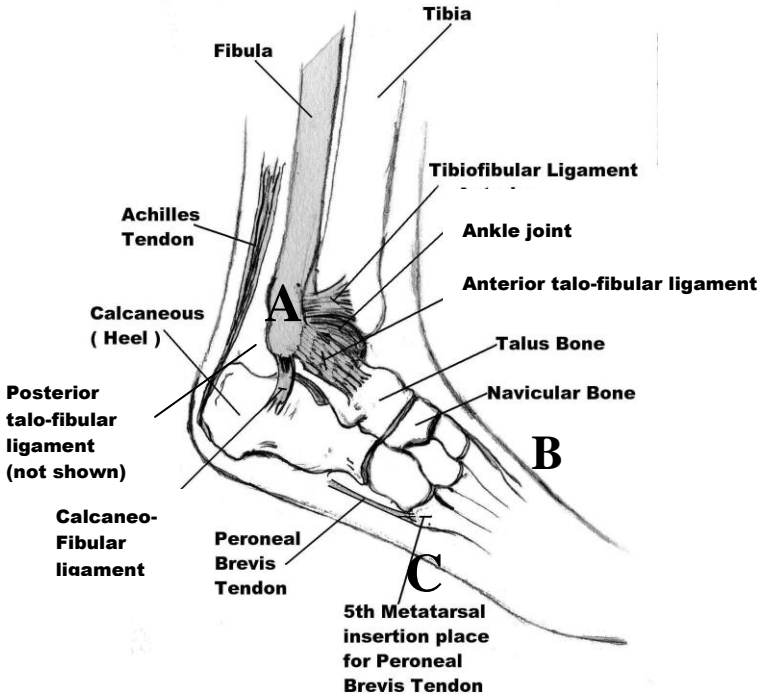
- no limp while walking in Emergency Room AND
- no pain behind or above lateral malleolus (A) AND
- no pain at medial malleolus

**Ottawa Foot Rules**

You don't need a foot x-ray when you have

- No limp while walking AND
- No pain at navicular bone (B) and no pain at 5<sup>th</sup> metatarsal (C)

Notice that x-rays are not recommended for swelling, pain, or bruising. These are expected findings in a sprain.





In adolescents, I recommend an x-ray after an ankle injury if there is pain at the fifth metatarsal (C), or pain at the inside (medial) of the ankle or at the growth plate of the fibula (A). And in small children, the fibula acts as a fulcrum, and ankle injuries can cause a fibula fracture close to the knee, therefore pain should be accessed at the knee as well. I also get an x-ray if the Ottawa Ankle Rules describe the need.

Treatment for **Grade I** ankle sprains involve ice, non-steroidals such as ibuprofen, early physical therapy, and return to sport. Immobilization is almost never necessary and actually could be harmful.

**Grade II** ankle sprains often need several days of inactivity and then physical therapy.

**Grade III** ankle sprains may need orthopedic consultation, prolonged rest from sport, and immobilization- and rarely surgery. Thankfully, this grade of ankle sprain is less common than the first two.

Physical therapy involves reduction of swelling and pain, return of normal range of motion and strength, and lastly (but most importantly), recovery of proprioception.

**Proprioception** is the ability of a muscle to remember its job. The easiest way to explain this important skill is

-close your eyes and touch your nose with your index finger. This is proprioception. Your finger knows exactly where your nose is- even without visual cues.

-Now, stand on one foot without leaning on furniture (this is relatively easy)... move your head back and forth while on one foot (this is much harder)... close your eyes while continuing to stand on one foot (this is hardest). As you remove visual cues, the proprioception of your ankle and knee muscles begin to work. This “muscle memory” is essential during running, jumping, and landing. Uneven playing surfaces, player contact, and unanticipated forces during competition require proprioception to avoid injury.

After a muscle is injured, its proprioception, or muscle memory is forgotten. It can take weeks to regain this without exercises. With physical therapy, proprioception is “remembered more quickly” allowing return to play more quickly as well. Athletes may notice their non-injured ankle responds more quickly during running or jumping than their injured ankle. This is not merely the pain due to injury. It is also the loss of proprioception. Athletes may call their injured side “weak”, “loose”, or “tired”. These may all be accurate- due to the injury as well as the loss of proprioception.

A non-athlete may not require physical therapy proprioceptive exercise since they are not doing things that challenge the recently injured ankle. Athletes anxious to return to practice and competition will likely jeopardize their recently injured joint with an unstable surface, unforeseen tackle, or unpredicted stress- and would benefit from physical therapy.

In fact, proprioception is so important, many high level teams use exercises with all of their athletes to prevent injury. Practicing proprioceptive skills can “teach” a muscle to respond more quickly in preventing an injury when the muscle is met with an unpredicted challenge.

An example is catching a ball. If you are expecting a ping pong ball to be thrown to you, but instead a bowling ball (or medicine ball) is thrown, your arms may not be able to catch it because you “were not ready”. Proprioceptive exercises prepare athletes for unexpected situations such as running on flat surfaces but encountering an uneven hole or rut on the soccer field.

The ankle sprain is typically considered an injury to one of the three ligaments.

In adolescents the fifth metatarsal is a common injury during an ankle inversion injury (twist). As the ankle turns in, the peroneal brevis tendon, attaching to the fifth metatarsal is pulled and the soft, growing bone in the adolescent can fracture. This avulsion fracture is found at the bump on the side of the foot. The bump is normal, but if there is pain, an x-ray can reveal a fracture.

A Jones fracture, on the other hand, is a fracture in the middle of the fifth metatarsal and is seen more in adults and must be treated very differently. The blood supply to the middle of the fifth metatarsal is not very good, and often this injury must be dealt with prolonged casting and occasionally surgery. The pseudo Jones fracture is more common in adolescents and should be protected for two to three weeks in a hard shoe or walking boot. Although it is a fracture, its cause is from an ankle sprain type injury and may or may not be associated with the typical complaints of ankle sprain pain.

A stress fracture to the growth plate of the lateral malleolus- the bottom of the fibula- has a similar cause of injury as the pseudo Jones fracture. With the mechanism of injury of an ankle sprain- the bone is softer and weaker than the relatively stronger ligaments and tendons- and the growth plate “gives way”. This situation typically causes swelling, limping, and pain. It is difficult to determine sprain versus growth plate fracture- although a growth plate fracture has more pain on the bone and may show up on x-ray- while a sprain does not hurt on the bone and never shows up on x-ray.

**Treatment Strategies for Ankle Sprain** see page 7 for info  
Medicine- 3: ibuprofen and topical medicines have helped with pain  
Physical Therapy- 4/5: the quicker the better!  
Acupuncture, Reflexology, Biofeedback, Manipulation Craniosacral, 2/3  
Surgery-0: rarely necessary  
Cam walker, casting, or complete rest- typically not necessary- although occasionally used for a day or two to reduce swelling and pain- get to therapy fast!  
Long term braces: 1: almost always weakens muscles and reduces proprioception, don't waste your money!

### **Common advice for ankle sprains**

#### **RICE**

**Relative rest** - do what does not hurt

**Ice** - ice bucket (1/2 water, 1/2 ice) is better than ice slushy bag (half water, half ice), which is better than ice bag (all ice)

**Compress** - wrapping the ankle after the injury helps prevent swelling

**Elevate** - elevation after the injury helps prevent swelling

After diagnosis and reassurance that it is not a fracture, ankle sprains should be treated with aggressive Physical therapy and return to activity.

### **THE MEDIAL ANKLE**

The medial ankle has a large ligament called the deltoid ligament- not to be confused with the deltoid muscle on top of the shoulder. The deltoid ligament in the ankle is large and strong. An eversion injury (the ankle and foot moves laterally) is less common. In my practice, I typically x-ray medial ankle pain injuries. Although I can not see the deltoid ligament on an x-ray, the mechanism of injury more often also results in bony injury.

#### **More on growth plate fractures:**

X-rays may also be considered if there is pain at or above either malleolus (the bumps on both sides of the ankle). Adolescents have open growth plates here and growth plate fractures (Salter Harris fractures) can be seen with an x-ray. Occasionally an MRI is used to detect these injuries. More commonly though, the injured ankle is compared with an x-ray of the uninjured ankle. These injuries can be very difficult to determine- as Salter Harris I fractures are simply a widening of the growth plate and are not "obvious" fractures of bone. Immobilization in a cast or walking boot is the treatment. This involves a **relative**

**restriction** from sport and so- the correct diagnosis and treatment is of utmost importance.

Missing this subtle fracture can result in prolonged pain, decreased mobility, and rarely, growth problems in that growth plate.

Over treating, while the safe thing to do, results in missed practice, and loss of proprioception due to muscle inactivity during immobilization.

I recommend a course of physical therapy after casting or cam-walker use to avoid a subsequent injury after immobilization due to poor proprioception. Therefore, it is important for the medical provider to be comfortable in not missing a growth plate injury, and also not casting every ankle injury, as most fall into the category of grade I and grade II sprains.

**Ankle braces and taping**, while frequently used immediately after an injury, and the following days to two weeks after, probably should not be used weeks to months after the injury. Although they may prevent minor injuries, they can not prevent major ones; while proprioceptive exercises are less of a burden, allow normal muscle movement, and do not allow for the “mental crutch” that the brace is the thing keeping your ankle “healthy”.

There are different theories, mine is the less bracing the better. While manufacturers making braces may disagree, I believe physical therapy and proprioceptive exercises are far better in recovering from an injury and preventing another one. There are studies though that propose braces should be used, as preventative injury devices. Some football teams, for example, use knee braces to help prevent medial collateral ligament sprains and reduce anterior cruciate ligament tears. These studies are ongoing. While interesting, for now, I believe adolescents, even at the premier level, do not need preventative bracing. This, like football helmets, may evolve as we learn more.

***Treatment Strategies for Ankle Injury*** see page 7 for info  
Medicine- 3: ibuprofen and topical medicines have helped with pain  
Physical Therapy- 5: heel cup, ice, proprioception/strengthening exercises, may reduce time out of sport by as much as months  
Acupuncture, Reflexology, Manipulation, Biofeedback, Craniosacral, 2/3  
Surgery-0: rarely necessary  
Cam walker or casting- 4This is typically not necessary unless a grade III sprain, a pseudo jones fracture of the fifth metatarsal, or a growth plate fracture of the fibula or tibia.  
Long term bracing- 1. I don't believe this is good therapy

## Case I:

A thirteen year old select level football player “rolls” his ankle during a game. He hears a pop and there is instant pain and swelling. He is forced to stop playing because of a limp.

The next day, his ankle is swollen and bruised. He limps into the doctor's office and has pain on the outside (lateral) of the ankle. An x-ray is done because

there is pain around the lateral malleolus, most of the pain is on the anterior talofibular ligament- not on the bone. The x-ray showed no fracture and no suggestion of a growth plate fracture compared with the x-ray of the uninjured ankle. The doctor diagnoses an ankle sprain, either grade I or II.

Treatment would be considered safe and standard of care if the doctor recommended:

Rest, ice, compression and elevation and two weeks off of sport with gradual reintroduction of walking, running, and “cutting drills” over the next three weeks is recommended. This five week return is safe and **“textbook approach”**.

Another treatment is one to two days of (RICE) and then begin physical therapy with the therapist to monitor return to play recommendations. Often therapy begins in the pool- where gravity is removed, progressing to land exercises, and finally game type activity (functional exercises). This may or may not reduce time out of practice. This more aggressive approach may be more acceptable to a highly competitive athlete- with the assistance of a therapist judging strength and safety on a day by day basis- rather than “waiting” for things to hopefully improve on a chosen date.

A third treatment is crutches and immobilization for two weeks and then begin physical therapy. While this treatment is appropriate for a grade III sprain, it is not standard of care practice for a grade I or II sprain and results in prolonged time off before return to play due to immobilization, loss of proprioception, and reduction of strength. **Therefore, more protective treatment is not necessarily better treatment.**

### **Warning signs of ankle injuries:**

Swelling without injury or trauma  
Pain on the inside (medial) ankle,  
typically more ominous injuries  
Deformation around ankle,  
the bones look funny

#### **Case II:**

A premier level eleven year old soccer player rolls her ankle while attempting to dribble the ball around an opponent. The following day, after ice and ibuprofen, she goes to the doctor. Her foot hurts by her little toe and notes that there is a “bump” on each foot at the outer side, but the injured side is more swollen. X-ray reveals a fracture at the back (base) of the fifth metatarsal- lateral foot behind the little toe. This is a common injury to growing adolescents after an ankle type injury. This avulsion fracture has a couple of acceptable treatments.

1. a post op shoe (hard soled shoe) can be used for three weeks or until no pain or limp, allowing ankle movement but protecting the 5<sup>th</sup> metatarsal. While acceptable, this may not offer enough pain relief for some patients.

It also doesn't offer protection during relative restriction- as the injured area is exposed and can be re-injured.

2. A cam walker boot can be worn for three weeks or until no pain or limp. While a more protective treatment, it also immobilizes the ankle and may require some physical therapy for ankle strengthening after the 3 weeks due to lost proprioception. It can not be stressed enough- while mending and resting the injured area, a walking boot, cam walker, or cast also immobilizes muscles, connective tissue, and vital structures that are not injured and also become weakened. Exercises to regain strength, and muscle memory (proprioception) protects the area from a new injury.

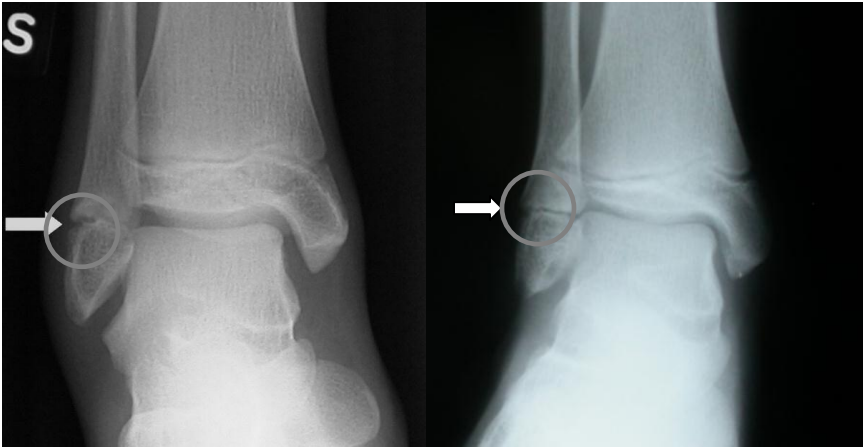
In this treatment, the injured area is better protected, but other structures in the foot are too- that don't necessarily need to be protected and may lose strength and proprioception.

3. No treatment at all may result in prolonged pain and limp. This is an unacceptable approach to this injury.

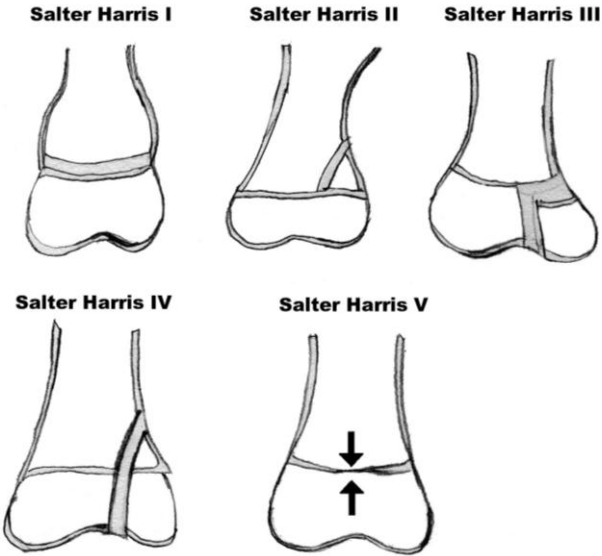
### **Case III:**

A thirteen year old soccer player trips over an opponent's leg and rolls his ankle. The following day, after ice and ibuprofen, he goes to the doctor. X-rays do not reveal an obvious fracture. Though after one week of physical therapy he explains that his pain is getting worse. A second x-ray is performed on the NON-injured ankle and the doctor realizes that the growth plate at the fibula (the smaller of two bones on the lower leg where the arrow is pointing) appears different on the uninjured ankle. He diagnoses a growth plate fracture.

Growth plate fractures are also called **SALTER HARRIS** fractures. There are five types listed below. Each has a different treatment. For the purposes of this book, suffice it to say that Salter Harris I fractures are often missed and, most of the time, thankfully heal themselves without long term problems. Rarely, the growth plate can be harmed (growth plate arrest) if not rested and growth can be altered at that bone.



The left x-ray shows a growth plate that is wide and irregular (larger arrow) compared to the opposite ankle-comparison- which is narrow and regular (smaller arrow).



Salter Harris II, III, and IV fractures are more serious and may result in orthopedic surgery and require closer follow up. Salter Harris V fractures are crush type injuries to the growth plate and more commonly result in growth problems to the injured bone.

This case represents a Salter Harris I fracture and acceptable treatments include-

1. Cam Walker walking boot for three to four weeks followed by physical therapy for ankle strengthening and proprioception.
2. Casting of ankle with crutches for three to four weeks followed by physical therapy.

Most patients prefer cam walker walking boots, allowing them to shower, remove the boot for brief times, and walk without crutches. For stress fractures, avulsion fractures, pseudo-Jones fractures, and Salter Harris I fractures, this is acceptable, as long as the patient is compliant with the treatment plan.

For patients that can not be trusted to wear the cam walker, casting is necessary to guarantee successful treatment.

Casting is also necessary when there is a more serious growth plate injury or the doctor does not wish to risk any movement or twisting after a surgery, reduction of a displaced fracture, or pinning of a severe fracture. These injuries require complete immobilization.

Lastly, talar synovitis can cause ankle sprain type pain. It often has a similar cause of injury, similar exam, and benefits from similar treatment. X-ray is not diagnostic, occasionally MRI is more helpful. Occasionally this diagnosis takes a bit longer to recover than an ankle sprain- and it is a diagnosis I consider a brace for the ankle for up to one month in hopes of reducing inflammation.

### Questions to ask your doctor

1. Is a growth plate effected?
2. If a cast is offered, can a boot do the same job- with the benefit of showering, and not using crutches- or is a cast necessary (sometimes it is!)
3. If sprain is the diagnosis- when should physical therapy start?
4. If physical therapy isn't helping as predicted, what is the next step, and when will that step be taken?
5. While I'm waiting for recovery, what can I do at practice during my **relative restriction** to ensure I stay in shape physically and also remain an active part of the team?



## Foot- Shoe Wear

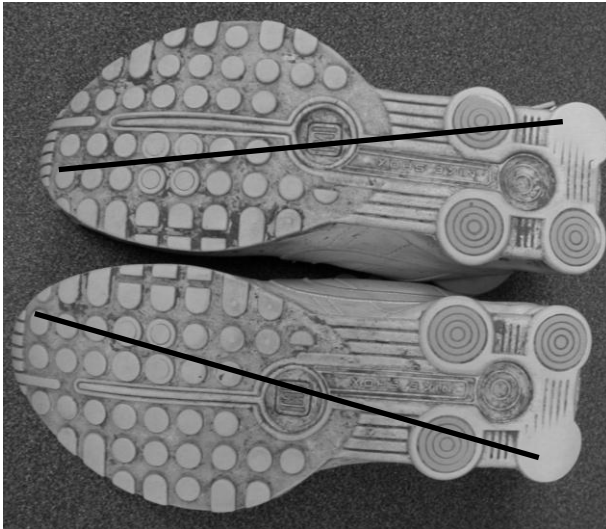
For most athletes, the foot is protected by shoes. Gymnasts, dancers, swimmers, and various other athletes are bare foot while ice-skaters, and ice-hockey players have altered shoe wear during competition. For most though, the feet are protected by an athletic shoe.

Shoes should be changed every four hundred miles for runners, and every season for ball sports. The soles of shoes wear down whether or not they are being worn. Thus even brand new shoes sitting on the shelf should be changed each year. (Young athletes LOVE this, while parents don't!)

While cleats help athletes turn and stop and dig in better, they also increase injury to young, inexperienced athletes. My recommendations are no cleats until absolutely necessary. Most seven and eight year olds can't run fast enough to make use of cleats anyway. And most thirteen year olds can tell a difference in their performance wearing cleats. The coach, and parents, must weigh the benefit of cleats to the risk of increased ankle, knee, and groin injuries due to inexperienced athletes stopping (or cutting) too quickly and injuring themselves. Remember, growth plates in the ankle and foot are soft compared to ligaments and tendons- turning too hard and "locking" the foot due to cleats theoretically can cause a growth plate injury. Cleats, if worn at all, should be plastic or rubber, similarly sized throughout the bottom of the shoe, and cover the entirety of the edges of the shoes.

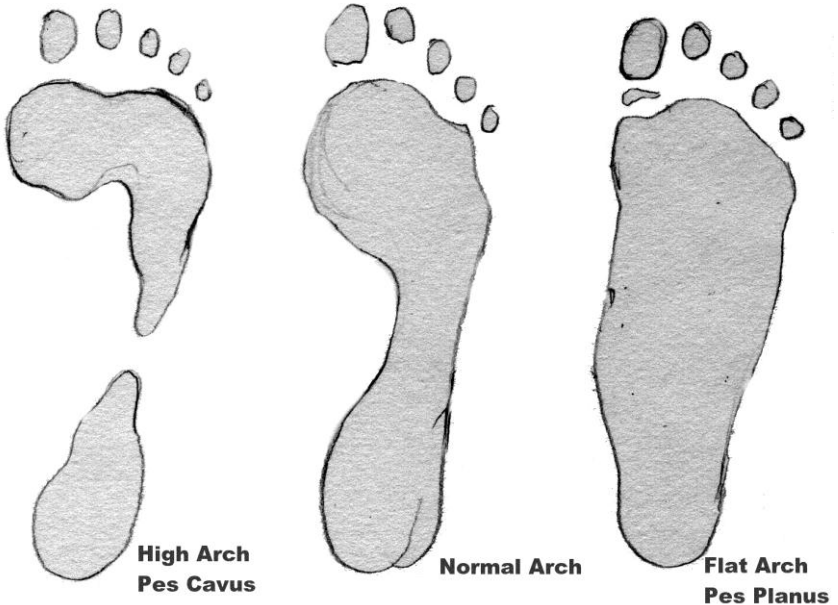
Shoe wear is predictable. Look at a pair of your child's season old shoes. The soles should be worn at the big toe and the opposite side, the outside, of the heel. A diagonal line can be drawn from both areas where the most wear is seen.

Normal Shoe wear



If this is not the case- your child may have flat feet, high arched feet, turned in ankles, or another cause for abnormal walking and running. This is the least expensive and most accurate way to see if your child needs inserts, expensive shoes, or a special podiatry consultation.

Another inexpensive and accurate test is the wet paper towel test. Moisten the bottom of your child's bare feet with water and have them step on a dry paper towel. Quickly circle the wet outline of your child's foot with a pen. Compare the picture to those below.



Remember that shoe manufacturers, insert makers, and specialty stores want you to buy their products. That doesn't mean your child needs it! Be glad your child is normal and realize that just because that shoe insert costs \$140 doesn't mean it will make your child faster! See your doctor if you think the pictures above suggest your child's foot is abnormal.

Lastly, even if your child is in a sport that is bare foot during competition, they likely wear shoes to the movies, to school, and during non-practice times! The best way to protect heels, ankles, feet, and even knees is to wear good shoes. Flip flops, high heels, and most sandals are not good shoe wear. The thin soles, poor ankle support, and completely flat shoe structure results in problems! Good athletic shoes, as well as many types of casual shoes with soft or gel arched soles and ankle support will protect your child's feet during the day and increase their longevity during workout and competition. Track and soccer shoes offer little support, have poor soles, and often have cleats. Caution should be used when wearing the shoes during these sports and these special shoes should not be

worn while not in sport- such as to the store, playing in the back yard at home, or on a hard surface such as the basketball court!

And yes, bare foot walking at home is safe- and natural- for the normal foot. The growing young child, in fact, benefits from bare foot walking in a safe environment.

When buying shoes (not flip flops!), look at the inside of the shoe. Does it have a gel protection for the heel? Does it have an arch in the sole? Does the bottom of the sole have tread offering protection from slipping? Does the material of the shoe offer the correct balance of protection from the elements without too much weight for speed? Is the ankle support acceptable? And lastly, will your child wear the shoe—is it comfortable and “cool enough” to be seen with friends?!

Shoes should be the most expensive, most frequent, and most careful purchase for your child. The rest of the uniform including helmets for football players, shin guards for soccer players, and grips for gymnasts are often chosen by the coach and then billed to the parent. Shoes are often left up to the parent and the athlete- buy wisely, money spent up front- on good shoes- could be money saved- not having to visit the doctor!

Here are recommendations for shoe inserts. Almost every adolescent athlete needing an increased arch support, heel support, or foot cushion will benefit from the inexpensive rubber, foam, or gel insert costing \$15-\$20.00. Although they must be replaced frequently, they are more comfortable and less expensive than custom orthotics. Custom orthotics are often too hard and uncomfortable and are outgrown by growing athletes before their cost is appreciated. While people making custom orthotics will tell you miracle stories about their product, they may simply be attempting to pay for the expensive car they just purchased! My advice is buy comfortable inserts- replace them often (as much as every 3 months)- and save the big money for a new pair of good shoes in 400 miles, the next season, or the next year.

### Shoes

Practical- good protection from the elements while not being too heavy

Basketball may require more ankle support while soccer may require better tread on the sole for uneven surfaces

Cushioned- soles should have good arch and protect heel and toes from impact

Stylish- if the athlete won't wear it, it doesn't matter how excellent it is made

Cleats- don't get them until you have to

**RULE OF THUMB:**

**Don't spend too much money on shoe inserts- your child will grow out of their shoes in 6 to 9 months anyway! Most inserts can be found at a sporting goods store and most orthotics are unnecessary (except in rare cases such as club foot and other severe foot abnormalities)**

**Questions to ask your doctor**

If custom- made orthotics are recommended, ask why.  
Children grow so quickly, expensive orthotics will often be outgrown before you get your money's worth.

## The Foot

Foot pain is a common reason for adolescent athletes to seek help from a doctor, although not as common as heel and ankle. The most frequent concern is toe and foot fractures from a fall, being stepped on, or having something... or someone... fall on it.

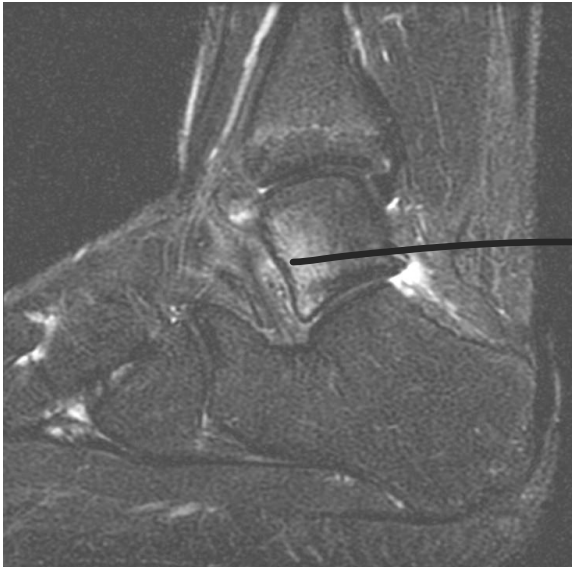
An x-ray is the quickest, least expensive way to get a diagnosis and return to sport. Toe fractures, with the exception of the great toe, can be treated with buddy taping and a hard soled shoe in most cases. If a growth plate is involved or the fracture enters the joint space between the phalanges (A), most athletes should have an orthopedist give their recommendations. Fractures of the great toe should be protected for three to six weeks. And fractures of the metatarsal bones (B) should be protected as well. Fractures of the tarsal bones (C) are less frequent and occur with large forces. The Navicular bone (D) and the middle of the fifth metatarsal (E) (Jones Fracture) are difficult to heal, and in my opinion, require an orthopedist or sports medicine specialist to become involved. Base of the fifth toe requires protection, but not necessarily an orthopedist's recommendations.



Sprains of the foot will not show up on x-ray and require an MRI to be visualized. The MRI may show joint space fluid, a suggestion of a stress fracture in a bone, or disruption of a ligament, tendon, or muscle. MRIs are recommended if the doctor has reason to believe treatment will change with a specific diagnosis, or if an injury is not getting better as quickly as predicted. Most muscle sprains, and even tendon and ligament injuries take three to six weeks before complete recovery. And most athletes are returning to practice and although not 100%, feeling better by two to three weeks. Injuries lasting longer than this may benefit from more conclusive diagnosis with an MRI. But all sprains and strains do not require special imaging.

### **Non bony injuries**

There are reasons to get an MRI sooner than two to three weeks. If a toe does not have movement for instance, and the bone is not broken, an MRI may reveal a disrupted tendon requiring surgery. Of course, a good physical exam may also lead to the same diagnosis without need for MRI. If there is ongoing pain an MRI may reveal a stress fracture of a bone. And if pain is more severe than expected from the injury explained, an MRI may reveal a ligament sprain at the tarsal bones (a Lisfranc sprain) requiring a cam walker boot, or surgery.



Stress fracture of talus bone

The white area is injury not evident on plain xray

Most of the time though, the x-ray is enough to ensure there is not a fracture and a week of relative rest will return the athlete to sport. Remember **relative restriction** is not removing the athlete from training- it is simply removing painful activities from practice.

And treatment and recovery in 2-3 weeks with altered practice is far better than

- no treatment and continued pain with decreased agility
- increased chance for further injury due to avoiding use of injured area

and better than

- complete restriction from sport and over-treatment if not absolutely necessary

**Turf toe** is a sprain of the soft tissue above the great toe from curling the toe under the foot and stretching the tendon. Rest and taping is typically all that is necessary. X-ray is reasonable to rule out a fracture of the great toe.

**Peroneal brevis tendonitis** occurs when the tendon that courses underneath the lateral malleolus and attaches to the fifth metatarsal gets irritated and causes pain and sometimes even tingling. This can occur with an ankle twisting type injury or with over pronation of the foot. Physical therapy and relative rest is all that is necessary. Surgery to “hold down” the peroneal brevis tendon is rarely necessary if MRI reveals the retinaculum that holds the tendon in place has torn.

Here are some more common foot injuries seen in adolescent sport. The common, but not absolute treatment is suggested.

1. Phalange fracture- buddy tape
2. Metatarsal fracture- cam walker
3. Tarsal fracture- cam walker or cast
4. Navicular fracture- refer to orthopod, cast
5. Jones fracture- refer to orthopod, cast, sometimes needs surgery
6. Pseudo Jones fracture- cam walker or hard soled shoe
7. Lisfranc Sprain- cam walker, sometimes needs surgery
8. Turf Toe Sprain- buddy tape and rest
9. Peroneal Brevis tendonitis- physical therapy

### **Warning Signs of Foot Pain**

Fever

Foreign Body, redness, discharge

Night Pain worse than activity pain

Limping that doesn't improve with initial treatment plan

These require consideration of infections, metabolic problems, and other non-sports injury diagnoses

**Treatment Strategies for foot injury**

See page 7 for explanation

Immobilization-4/5 necessary for fractures but not for most sprains

Surgery- typically not necessary

Special shoe wear-2, lifts, custom orthotics, and special shoes typically not necessary, inexpensive shoe inserts may help

Physical therapy- 3/4, may be helpful

**RULE OF THUMB:**

If the athlete is limping,

Pain is 4/10 or greater

Pain has been over one to two weeks,

Or there is a visual deformity,

it's time for a medical professional to be consulted.



# The Leg

The portion of the leg above the knee is composed of the femur bone and the strongest muscles in the body, commonly described as the quads in the front, and the hamstrings in the back of the leg. The hip muscles including the gluteus muscles, flexor psoas and groin muscles are also incredibly strong and part of the CORE stabilizing musculature.

The lower portion of the leg below the knee is composed of two bones, the larger tibia and the smaller fibula. The muscles in this area are smaller and in a very tight space surrounded by muscle and connective tissues.

Leg injuries are common and usually traumatic from a fall or something falling on the athlete. Injuries such as fractures, cuts (lacerations), rubs (abrasions), and burns are relatively easy to diagnose and often are cared for in an emergency room.

Listed below are some not so easy to deal with injuries that an adolescent athlete may encounter.

## **MTSS- Medial Tibial Stress Syndrome is known by most as “shin splints”.**

Seen in runners, soccer players, and dancers, this issue is often a season long nuisance. Importantly, MTSS is pain covering several inches on the shin. If the pain is most severe in one location that is an inch or less in space, another diagnosis should be considered.

The reasons for MTSS are varied but almost always deal with

- running flat footed rather than heel to toe
- worn out shoes or the wrong type of shoes
- too fast of an increase in distance running or too much change in incline or decline with run

Shin splints (MTSS) do not need special tests, the diagnosis can be made in the office.

The treatment is relative rest (a decrease in distance and incline/decline activity), new shoes, check the running technique, and gradual reintroduction into full sport. Physical therapy often can help with a quicker return and assistance in correcting any improper technique.

This is one of the best opportunities for the Dixie Cup ice massage.

### **Dixie Cup Ice Massage**

Take a Dixie Cup and fill it with water. Place it in the freezer.

When your athlete is picked up from practice or a competition- take an ice filled cup with you in the car. Tear the top of the Dixie Cup until the ice is exposed.

Hold the paper cup upside down and rub the shins with the ice in a circular motion for ten minutes. Push lightly if in a lot of pain, push down if you would like a deeper massage.

### **Warning Signs of MTSS**

Point tender in an inch sized spot rather than a line of pain down the shin, think stress fracture

Fever, night pain worse than exercise pain

Limping after one to two weeks of treatment

MTSS can be diagnosed when something else is actually going on. The best indicator for a different diagnosis is point tenderness. If the pain is worse in one spot rather than pain going down the entire shin, then a stress fracture should be considered.

X-rays often show thickening of the bone at a site of stress fracture. Often occurring for the same reasons as shin splints (MTSS), a stress fracture is an area of bone that just couldn't handle the impact any longer.

These injuries can be rested without immobilization in most cases and physical therapy is helpful for a quicker return to sport. Some doctors choose to protect the area by putting a full leg immobilizer (air splint) or lower leg cam-walker on the patient. I have not seen the necessity of this in my practice.

Four to six weeks is usually necessary before a complete return, while gradual increase in exercise can take place after the third or fourth week as long as pain free. Not resting results in chronic pain and typically a wasted season with poor times, unfinished goals, and setbacks compared to team mates.

Although rare, point tenderness may also be a sign of bone cysts, tumors, or other "space occupying lesions". These typically show up on x-ray, bone scan, or MRI.

They may be associated with fever, night pain (rather than pain during exercise), or fractures with little trauma. These can occur anywhere in the body, but often are found in the hip, femur, and lower leg. Thankfully, they are typically benign (not malignant cancer) in this age group- although a thorough exam is necessary to ensure it is not a rare cancer such as Ewing’s sarcoma, osteosarcoma, or leukemia.



**Benign Fibrocortical defects in tibia** where the treatment is “purposeful neglect”, the doctor explains the finding but there is no treatment necessary.

**Cancer is NOT common in kids**

Average number per year per million kids under 18, National Cancer Institute

Leukemia	about 40 per million kids per year
Bone cancer	about 10 per million kids per year

**I know you just stopped reading because of the last paragraph!** Cancer is rare- but a reality in adolescence. Almost all athletes with pain have a sports injury and nothing more. It is still important to have a doctor involved though. The coach and enthusiastic parent pushing for the next competition are almost always correct in saying, “a little pain is not bad”, or “you have to work with a little pain”, or “we can rest at the end of the season”. It is not the job of the parent or coach to think of the tiny percentage of patients that have something other than a sports injury. But your doctor does have this in mind and it is paramount that while the coach is

pushing for athletic success, nothing more serious is missed. **It is the doctor's job to help you with the common injury and not miss the uncommon one. Let your child's doctor do their job.**

Benign lesions such as unicameral bone cysts and fibrocortical bone lesions are common and can be found because of a small trauma that results in a large fracture, a pathological fracture. The majority of the time though, they are found while xraying an extremity after a trauma- and finding the cyst incidentally- the cyst neither causes pain or trouble- but is found because the x-ray was taken. This boneless area (cyst) is often found in the hip or femur and some people have more than one. While not a malignant cancer, they can become dangerous because of the weakening of the bone around the cyst (if it gets big enough) but most of them cause no problem at all- and can be watched without treatment. When the athlete stops growing, the fibrocortical bone lesions normally stop growing too.

A real example:

A gymnast, who unknowingly had the cyst for years, finally realized its existence when she jumped off the low uneven bar and her femur fractured. The cyst had slowly enlarged until the bone around it was not strong enough to handle the stress of the simple jump the gymnast had done hundreds of times before.

Treating the cyst that is very large normally involves surgically removing it or filling it with a bone like material. The fractured area must also be casted, pinned, or otherwise stabilized. Return to sport is acceptable and the cyst does not recur, or risk cancer, or other future problems- although other cysts may be found if full body x-rays (skeletal survey) are performed.

Sometimes these cysts are accidentally found while x-raying a bone for another reason- such as an unrelated injury. Treatment decisions can be made before a fracture occurs, although these cysts are commonly undetected until they cause a problem. Unicameral bone cysts are not common enough to “go looking for” in every athlete- but your education about them is important because they can cause a fracture (pathological fracture) while not being from a trauma or a cancer.

**Causes of Pathologic Fracture**

Medical reason rather than traumatic

**Metabolic**

Rickets- Vitamin D deficiency

Hypoparathyroidism

Diabetes

**Osteoporosis/Osteomalacia/Osteopenia**

Eating disorder, nutrition deficiency

Osteogenic imperfecta, genetic

**Space occupying lesion**

Unicameral Bone Cyst, fibrocortical bone lesion, other tumors

**Infection in bone**

Osteomyelitis bacterial infection, TB

**Strains of muscle in the lower leg-** Strains are relatively common, especially in soccer, football, and running. Typically a week or two of rest and reintroduction into the sport along with ice and NSAIDS are all that is necessary. Most kids can continue some form of their sport while healing.

**Warning sign of strain to muscle THE DREADED “P’s”!**  
**Compartment Syndrome**

Severe **pain**,  
loss of color (**pallor**),  
loss of sensation (**parasthesia**),  
sometimes (not all the time) a loss of pulse (**pulselessness**)

**Compartment syndrome** is a relatively uncommon diagnosis- but one that can not be missed- and typically isn’t dangerous because of just the pain. Emergency room doctors and orthopedic surgeons are usually met with this dilemma. During a strain or severe muscle trauma, blood accumulates in a closed space and has nowhere to “leak”. The pressure builds until vital structures such as blood vessels, nerves, and lymph vessels are “squeezed”. This leads to pain, loss of blood flow, and sometimes, loss of sensation. Time is critical- and release of pressure through a surgery is necessary. To prove this diagnosis, an instrument is placed into the muscle to check the pressure. If too high, a fasciotomy (release of pressure by cutting connective tissue) is necessary. This is an uncommon problem- but one that can not be overlooked. It can also occur without a trauma but during exercise- exertional compartment syndrome. The diagnosis and treatment is similar.

The last uncommon but important diagnosis to be discussed is **myositis ossificans** (MO) which might also be called heterotopic or exostosis bone formation. This can occur in the legs or arms after a muscle trauma. The bruised muscle “gets confused” and rather than replacing injured muscle with new muscle, your body replaces the injured muscle with bone! The classic area for this to occur is in the thigh after a severe hit to the quad such as a football helmet of an opponent to the thigh of the patient during a tackle. Too aggressive of stretching or therapy after the injury seems to be a trigger for MO to occur. Careful stretching and ice with delayed therapy appears to decrease the chance for it.

The misplaced bone typically goes away on its own with rest, although sometimes gets large enough to require surgical removal. X-ray is the most common way to follow this uncommon and seemingly bizarre problem.

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**Case I:**

A fourteen year old football player is tackled and has instant pain in his lower leg. He limps off the field and is unable to return to the game. X-rays reveal a fracture of the fibula.

The fibula is a non-weight bearing bone, so even if fractured, the athlete will be able to walk, but with pain and limp. Professional athletes may even get the lower leg tightly taped and return to the game. Although possible, this is not recommended as the athlete may end up with a second injury due to the pain, slowing, and thoughts about the initial injury to the fibula.

Treatment involves protection and rest from sport, although the athlete is normally allowed to bear weight.

**Case II:**

A sixteen year old baseball player is hit in the lower leg with a fast ball pitch. He limps to first base and is thrown out while trying to steal second. That night, his lower leg is throbbing and he believes it is just a bad bruise.

The following day, x-rays are normal, but the doctor notices the athlete’s leg is cool compared to his uninjured leg. Muscle probe shows an increased pressure and an emergency surgery is scheduled. Blood accumulation resulted in a compartment syndrome.

Typically, this injury would result in bruising, but compartment syndrome should be considered if the injury is associated with tingling, temperature change, severe pain, or change in pulses.

**Case III:**

A twelve year old female softball player complains of shin pain, pointing to the worst spot in the middle of the tibia. She has believed it was shin splints for the last month.

Because it is in one point rather than a line down the shin, she goes to the doctor. X-rays show a thickened area of bone at the site she pointed.

If the x-ray does not reveal the injury, a bone scan or MRI would. This testing is typically not necessary.

The stress fracture is rested with batting allowed but no running. Physical therapy is started and she is allowed to return to practice and tournament play by the sixth to eighth week.

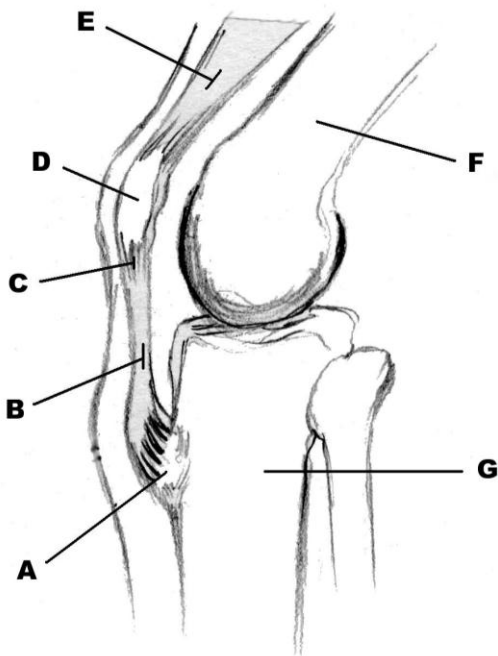
<b><u>Common leg sports injuries</u></b>	<b><u>Less common leg sports injuries</u></b>
Medial tibial stress syndrome (shin splints)	Stress fractures
Strains of muscle	Myositis ossificans (MO)
Fractures after trauma	Compartment syndrome
	Pathologic fractures
	Due to bone cyst or weak bone or tumor

## The Knee

Although the knee is not the most complex joint, it is possibly the second most injured in sport- after the ankle- and so this portion of the book is separated into several parts. The first part covers the most common reason for knee pain- Patellafemoral syndrome, or simply anterior (front) knee pain. The second part covers knee pain involving anatomy outside the knee joint- such as the patellar tendon. The third part covers knee pain involving the knee joint- and typically the types of diagnosis leading to surgery.

### Knee Anatomy

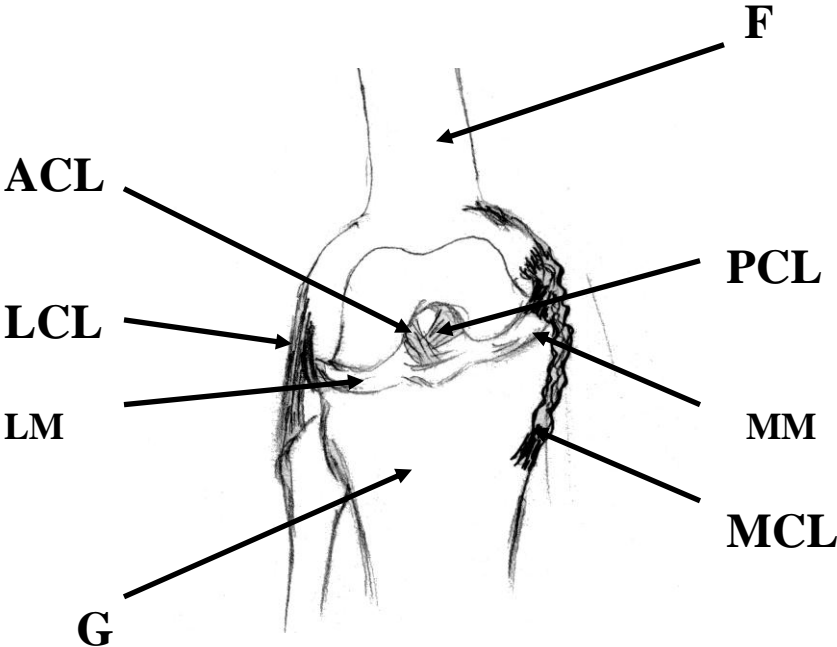
The knee is a gliding hinge joint. The large femur bone (F) joins the smaller tibia bone (G) of the lower leg. The knee cap, or patella (D), sits above the joint and acts as the fulcrum for the quadriceps(E)/patellar tendon (B). The fibula sits on the outside of the joint and acts as a connection for several muscles and connective tissues but actually is not a weight bearing bone, but it does act as an important place to connect ankle ligaments!



Outside the knee joint is the tibial tuberosity (A)- the connecting point for the patellar tendon (B). There is also an upper connection to the patellar tendon on the patella (C).

The inside of the knee is protected by the Femur (F), the Tibia (G) and covered by the patella (removed in picture below). The tibia is prevented from going too far

forward and slipping away from the femur by the anterior cruciate ligament (ACL). The tibia is prevented from falling too far backward and slipping away from the femur by the posterior cruciate ligament (PCL). The femur and tibia are cushioned by the medial meniscus (MM) and lateral meniscus (LM) acting as cartilage pillows/shock absorbers. Lastly, the femur and tibia are prevented from excessive outside force pushing them medially by the “tight rubber band like” medial collateral ligament (MCL). The fibula/tibia and femur are prevented from excessive inside force pushing them laterally by the “tight rubber band like” lateral collateral ligament (LCL).



**Patella femoral Syndrome (PFS)**

Entire books have been written about knee pain caused by patellafemoral syndrome. This book will merely brush the surface in the attempt to expose you to some common understanding of this incredibly complicated, yet common, cause for knee pain.

**Names for PFS**

Patella femoral syndrome      Anterior knee pain  
 Q angle knee pain  
 Used to be synonymous with chondromalacia- today they are  
 considered two different problems



The simplest explanation of PFS is the patella does not glide evenly over the knee joint causing a stretching of soft tissue, inflammation, and pain. Years of “tilted” patella movement can lead to a wearing down of cartilage underneath the patella and eventual destruction of the cartilage- called chondromalacia. This typically leads a fifty or sixty year old to the orthopedic surgeon who may recommend “shaving” the injured cartilage off by an arthroscopic procedure.

If the “titled” patella movement is corrected in adolescence, correct movement may prevent chondromalacia and the eventual need for surgery.

### **Causes of PFS**

Q angle syndrome  
Vastus Medial Oblique weakness (VMO)  
Foot abnormality such as “flat feet”

### **Signs of PFS**

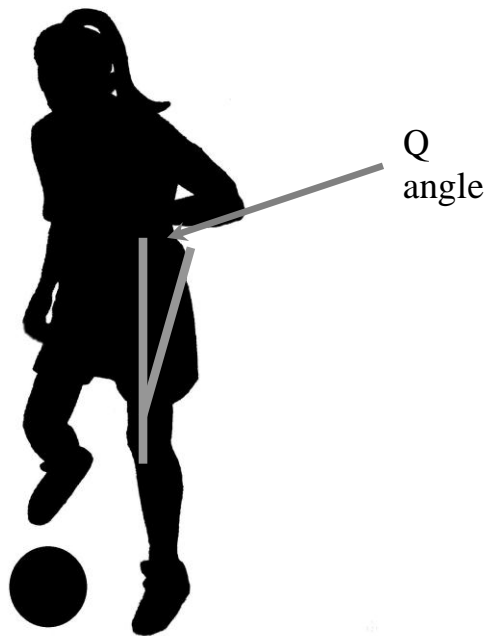
“Goldstein” sign, or “J” sweep sign (this is not an official sign)  
Movie theater sign  
Stair climbing sign

### **Warning Signs it may not be PFS**

Fever	Limp
Night awakening with pain	Traumatic knee pain (injury)
Patient points with one finger where pain is	

### **Q angle Cause for PFS**

Classically, the Q angle is the cause of PFS. The normal Q angle is less than 15 degrees in men and 18-20 degrees in women. An increased Q angle will force the patella laterally- thus stretching medial connective tissues and causing an abnormal glide. Eventually this will cause inflammation, swelling, and pain. The Q angle can be increased by being overweight, pregnant, during the onset of puberty in females, and countless other reasons.



The Q angle is made with two lines- the first is a vertical line from tibial tuberosity up the femur. The second line is from ASIS (anterior superior iliac spine- the bump on the front of each side of the hip) through the center of the knee cap.

Decreasing the Q angle is not always easy- but does work in reducing knee pain. A pregnant woman having her baby is the classic example of reducing Q angle and having knee pain get better! Physical therapy is always the treatment for PFS- unless you wait long enough to permanently injure the cartilage, requiring surgery to remove the injured cartilage under the knee cap- typically after fifty years old (in the “old days” patients would have surgery at a much younger age- now physical therapy is considered standard of care in the attempt to not have the patient go through surgery and risk the anatomical health of the patella and its undersurface).

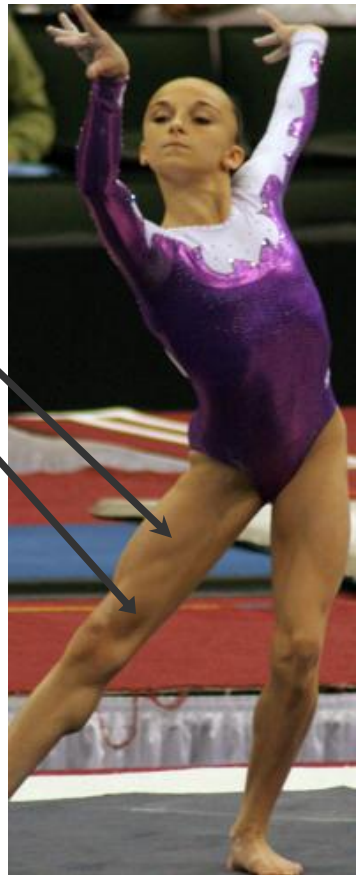
### VMO Dysfunction

The vastus medial obliques muscle is smaller than the vastus lateralis- but it still serves an important function.

Vastus lateralis

VMO

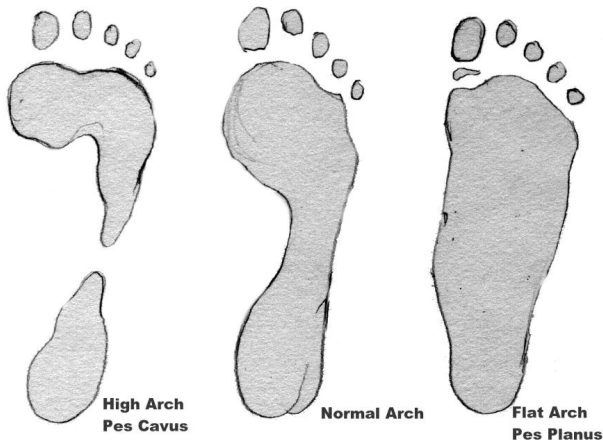
If the VMO gets too weak with its ratio to the vastus lateralis and the hamstring, the patella will not glide in the center of the knee joint. **Athletes with PFS most likely have this as the cause of their pain along with the CORE muscles such as the gluteus muscles not working efficiently.** Strengthening the VMO and gluteus muscles will reduce pain. The VMO should be about 30-40% as strong as the larger vastus lateralis. If it is only 25% (or less) as strong- then PFS can occur. Once again, physical therapy is the treatment and if done regularly, is almost always successful.



### Foot abnormalities

Knee pain can be caused by problems above the joint or below it. A flat foot with poor arches can change the angle of the lower leg and femur. This will send the patella away from the center of the joint. Weak ankle muscles can also alter an athlete's run and cause knee pain due to the patella gliding off center.

As you may have guessed, physical therapy and foot orthotics are the treatment.

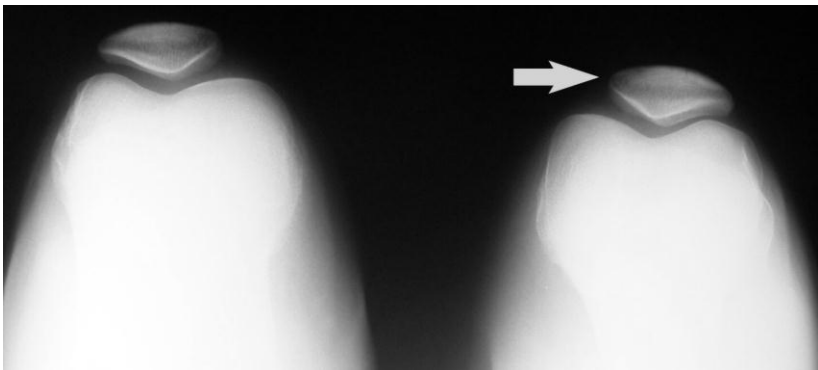


**Diagnosing PFS**

Physicians should be involved in diagnosing this common cause of knee pain. It is found in kids as young as nine years old and in adults as old as ninety! Athletes complain that pain is in the front of their knee. When asked to point to where the pain is, **the athlete almost always sweeps his finger under the knee cap (“Goldstein’s sweep sign”)**. This is different than other causes of knee pain where the athlete can point with one finger exactly where their knee hurts.

Athletes have more trouble with going up or down stairs (stair climbing sign), running on uneven surfaces, and rising after sitting for some time (movie theater sign). An athlete with “Goldstein’s sweep sign” and at least one other sign is almost guaranteed to have PFS!

A sunrise x-ray (with the leg bent) can show a tilted patella- with more space on one side of the patella than the other.



Patella femoral syndrome (normal sunrise view on the left and abnormal tilt of the right - arrow)

Taping the patella in the office and having the patient run stairs will surprise the athlete that the pain is improved... or completely gone. This is also reassuring that the examiner has correctly diagnosed PFS. The taping works- but only for a short time, 20 minutes is all that is necessary for the tape to stretch, get too elastic, and have no effect on holding the patella in the correct position.

While x-rays are not absolutely necessary, I typically recommend them just to rule out unusual problems such as a benign cyst, tumor, or surgical problem such as osteochondritis dessicans- discussed later. And the sunrise view x-ray is impressive for athletes to visualize just how tilted the patella is compared to what is expected normal.

### **Treatment of PFS**

Physical therapy is the treatment- and is important. Years and years of untreated PFS may result in non-repairable injury to the cartilage under the patella- requiring arthroscopic surgery to remove.

While physical therapy does work- it is commonly done with the physical therapist and then forgotten. Athletes want to get better, but when they improve, forget to continue the exercises at home- and eventually get the pain again. Unless the reason for PFS was pregnancy- and having the baby reduces the Q angle and thus the knee pain- athletes will need to do exercises if they want to have pain-free knees. How long you ask... I recommend a home exercise program three times a week as long as you want pain free activity- yep, that could be a long, long time.

***Want to keep your teeth? So you brush them every night.  
Want to survive a car accident? So you wear a seat belt...every  
time you're in the car.  
Want to do activity without knee pain? Do your exercises!***

Although a physical therapist is really necessary to learn the proper technique- suffice it to say, exercises that bring the patella back to center will correct the knee pain.

If the patella is too far lateral (typically in VMO dysfunction and Q angle syndrome) then half lunges and half knee extensions will activate the VMO and gluteus (buttocks) muscles helping to bring the patella back to center. While you can't change the anatomy of your hips, losing weight can help if Q angle syndrome is the cause- your hip bones are not going to change though- and there is an angle that the athlete is going to have to live with.

If the problem is in the feet, often a foot orthotic to correct flat feet will help. Physical therapy to bring the patella to the center is helpful, as is proper running technique.

PFS is complicated and can be caused by a number of reasons. It is very common.

**A good doctor and a great physical therapist is the key.**

This is a diagnosis where if you had to choose- the physical therapist is the most important professional for cure- more so than the coach, the parent, the doctor, or the surgeon!

**Strategies for Therapy** see page 7 for info

Surgery- 0, not necessary unless PFS for many years

Physical Therapy- 5- absolutely

Medication- 1-will help, but only to relieve pain, not the actual problem

Chiropractic- 2- may help but PT probably more useful

Injections-0- not helpful

Complete rest- 4- this will help but will come back with return of exercise unless you do PT

**Questions to ask your doctor**

Am I going to get physical therapy?

Everyone with PFS diagnosis should have the opportunity for physical therapy.

**RULE OF THUMB:**

**If there was no injury or trauma,**

**The athlete has increased exercise recently,**

**The patient is growing**

**or possibly overweight or pregnant,**

**and they can NOT point at exactly where the pain is (rather it is all around the kneecap)**

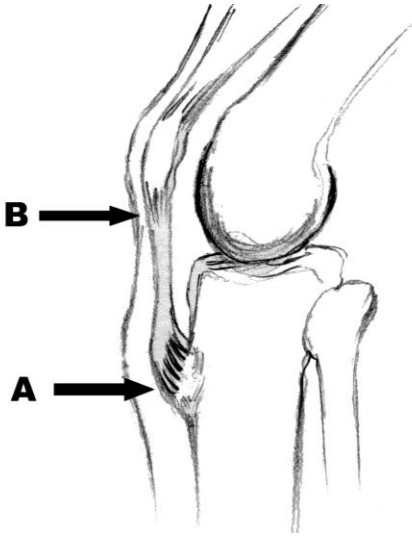
**THINK PATELLAFEMORAL SYNDROME!**

**Knee Pain Outside the Knee Joint**

The knee is a common source of pain for the athlete. Although patellafemoral syndrome is the most common reason for knee pain, there are other frequent complaints from adolescent athletes.

The following chapter will illustrate two basic areas of pain. One involves the patellar tendon complex and the other involves other connections of connective

tissues near the knee. The patellar tendon can “hurt” at the tibial tuberosity (A), or at the bottom of the patella (B). This results in osgood schlatter type pain if at the tibial tuberosity and Sinding Larson Johannson type pain if at the inferior pole of



the patella (B). In either circumstance, the patellar tendon is stretching and rather than tear, it pulls a tiny amount of bone at the apophysis (growth area).

This is called osteochondrosis. It is similar to the problem with the Achilles tendon pulling on the heel-called Sever’s or calcaneal apophysitis.

In adulthood, bone is hard and fractures. Ligaments and tendons are brittle and tear. But in adolescence, bone is soft and more easily pulled away from itself. Ligaments and tendons are incredibly stretchy and

refuse to tear except in rare circumstances. Thus when the athlete’s bones grow or there is repetitive forces stretching a ligament or tendon- it is more likely that the bone will lose and the connective tissue will win in a “tug of war contest”, if you can imagine.

As the patellar tendon stretches, it can become inflamed, although rarely tears. This patellar tendonitis may be called “jumper’s knee” and may or may not involve the tibial tuberosity or inferior pole of the patella. Regardless, pain at any of the three sites is due to excessive stress on the patellar tendon resulting in inflammation and pain.

<p><b><u>Types of Patellar Tendon Pain</u></b>                  Osgood Schlatter Pain                  Sinding Larson Johannson Pain                  Patellar Tendonitis</p>
<p><b><u>Reasons for Patellar Tendon Pain</u></b>                  Growth spurt                  Overuse- repetitive stress of patellar tendon</p>
<p><b><u>Warning Signs of Patellar Tendon Pain</u></b>                  Limp                  Fever                  Night Pain                  Injury causes worsening pain                  Increased swelling of Tibial Tuberosity</p>

Although an obvious diagnosis, x-rays are typically taken to rule out any other cause for pain. Athletes will point with one finger to the site of pain, (A), (B), or in the middle of the two points- the patellar tendon. Pain can occur in one or both legs and typically gets better with rest and after a growth spurt slows down. Osgood schlatter pain and Sinding Larson Johansson pain will always go away when an athlete stops growing, while patellar tendonitis pain can occur anytime- even throughout adulthood.

While the pain can be quite severe (6-8/10)- it rarely causes trouble. Athletes continue in their sport, if they can endure the pain. Inflammation can get bad enough to cause a lump at the tibial tuberosity. This doesn't necessarily mean a worse case of Osgood schlatter pain or worse pain than a team mate without a lump. It is important to know that the pain will eventually improve, but the lump may never go away- even in adulthood.

Very rarely, the **tibial tuberosity can fracture** away from the rest of the tibia, requiring a surgery to screw it back into place. This is rather unusual- x-rays will suggest the problem. **Athletes will be in considerable pain, limp, and the clue will be a greatly increased swelling at the tibial tuberosity.** I follow severe Osgood schlatter pain with x-rays at least annually during growth and anytime swelling increases or pain dramatically increases- possibly up to every 1-3 months in "risky" cases and less often (or only once) in typical cases. MRI will show the degree of inflammation and severity but is rarely necessary.

If the tibial tuberosity is normal then continued participation is allowed if the athlete can tolerate the pain. The physician must recognize developmental changes in the knee- the tibial tuberosity does appear different during stages of growth. If the tibial tuberosity appears widened, pain free activity is acceptable or knee immobilization for rest (if the pain is more severe)- immobilization is required less often.

If, on the other hand, the tibial tuberosity is not connected on x-ray, an MRI will show fluid accumulation and the amount of fragmentation. Surgery to screw the fragmented portion back to the tibia is rarely necessary and a sports orthopedic surgeon can help make these important decisions that will result in temporary restriction from sport.

**Treatment strategies for Patellar Tendon Complex Pain**

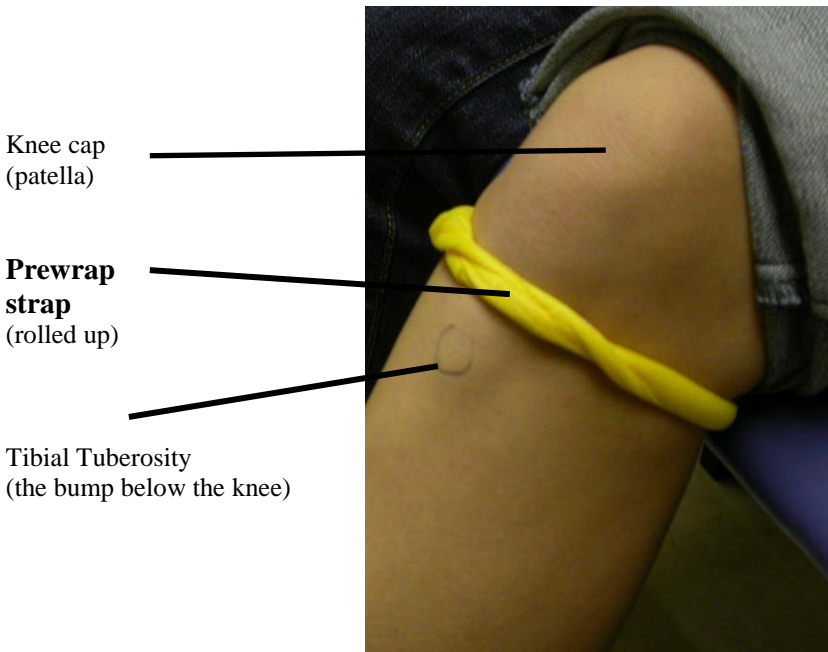
- 5, Ice with Dixie Cup massage
- 5, Relative Rest, stop activity if limping
- 5, NSAIDS on "bad days"
- 5, Patellar Tendon Brace
- 5, Stretching patellar tendon
- 5, Strengthen hamstrings
- 5, Stretch calf muscle and Achilles tendon



## **Making a Pre-wrap strap**

Buy pre wrap at any sporting goods store, it is inexpensive and comes in many colors. Wrap several loops of prewrap around the athlete's lower leg. Roll the prewrap up until it is above the tibial tuberosity and below the patella. It should be tight enough that you can't pull it away from the knee. At the end of exercise, it can be cut off and thrown away. A roll of prewrap will make dozens of patellar tendon braces, possibly even for an entire season.

The pre made straps with Velcro are often not small enough for young athletes, and often slip when the athlete perspires- causing an interruption during competition. The strap is typically more expensive than pre wrap as well.



Treatment may also include a patellar tendon brace. This “trick” on the patellar tendon changes the pull on the insertion points and may reduce stretching and pain. Most athletes say they get some, but not total, relief from this treatment. Buying a patellar tendon brace is one choice- although small athletes may have a hard time finding one that stays on. A second option is to buy “pre-wrap” and form a perfectly fitting patellar tendon strap each and every time.

The other causes for non-joint pain include strains of muscle and tendons around the knee including the hamstring, calf, and quadriceps. Lastly, the attachment of the **iliotibial band (ITB)** connects to the fibula, right next to the knee. Each of

these can cause pain behind and outside of the knee. It almost never involves the knee joint. Treatment involves, you guessed it, physical therapy and ensuring that running technique is correct.

### **Questions to ask your doctor**

1. If the doctor asks you to rest from sport, ask why. Instances of tibial tuberosity fracture may indeed require rest (or even surgery), while simple Osgood Schlatter syndrome will definitely hurt less with rest but may not be dangerous to continue participation.
2. Would physical therapy help? Achilles, hamstring, and quadriceps stretching and strengthening can help in some instances.

## **Knee Joint Pain**

While seen most commonly in football, soccer and other high contact sports, knee joint injury can occur in any sport. Injuries to the knee joint are usually traumatic, painful, and obvious. The athlete may feel or hear a popping. Swelling and reduced range of motion is common as well as hesitation by the athlete to walk or move the injured knee. Rarely though, an athlete can finish the competition, swelling increases over a couple of days and the athlete only seeks help when a catching or giving out sensation occurs during running at the next practice or game. While surgery is the typical treatment, it is not the only option in some cases. This chapter will briefly discuss each injury.

### **The ACL**

The Anterior Cruciate Ligament prevents the tibia from going forward beyond the knee joint. Injury may occur from falling forward in a snow ski injury, a tackle from behind in football, or an improper forward landing on vault in gymnastics. **Women are up to ten times (depending on the study) more likely to injure their ACL than men.** Research continues to attempt to learn why there is such an increased risk to women, especially noted in soccer. Theories include a smaller knee joint that “traps” the ACL and treats it as a noose or guillotine, cutting it in half. **Other theories include hormones (especially at risk just before and during menses),** running style, and a shorter, smaller ACL that is “too tight”. Regardless, women appear to be at increased risk. Even so, men are typically in more full contact sport, and thus are also seen in the orthopedic surgeons office with similar injury.

Athletes will complain of difficulty stopping in a run without the knee giving out, or complete inability to walk at all. Pain is “behind the knee cap” and often there is swelling around the knee.

The ACL can be tested with the Lachman sign, the Anterior Drawer Sign and other tests while on the field. MRI is the most valuable proof once in the office. In most cases surgery is the treatment, although small incomplete tears can be watched in young children to see if functional before obligating reconstruction. Surgery in a growing child must also consider whether the surgery will be appropriate and “fit” once adult sized.

Surgery is normally required to fix the ligament in patients that are teenage or older. There is controversy on what is best in managing this surgery. Rarely if ever can the actual ACL can be fixed, so something else must be used in its place. Options include taking a piece of the patient’s patellar tendon or part of the hamstring to use as the new ACL while other surgeons use a cadaver graft (from a deceased person). Each has their benefits and risks. Options are often decided by the surgeon’s past experiences, and the patient’s age, sport, and speed of recovery desired. Tendon grafts are actually stronger than ligament but because a doctor placed it, may not be as anatomically “perfect as mother-nature intended.” It is my recommendation to get more than one opinion before surgery to ensure you are getting the option that is best in your circumstance.

**Most surgeons- even the “best ones”- are comfortable with you getting several opinions before choosing the doctor that is best equipped to handle your situation. Everyone wants the best outcome for each unique situation.**

Once surgery is complete, months of physical therapy are required to return normal motion and strength to the knee joint. Often the hamstring and quadriceps muscles are weakened because of the injury, surgery, and rest required. Return to competition can take six to nine months.

### **ACL Injury**

MRI is the diagnostic tool

Surgery is typically the treatment, sometimes observation is appropriate

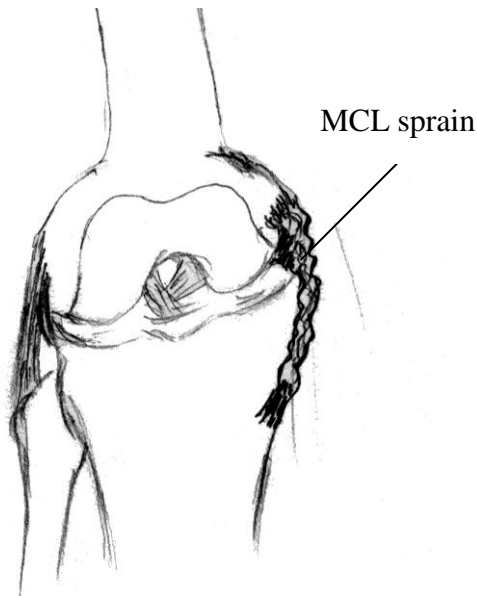
It is unusual to only tear the ACL- usually other structures are also involved

Physical therapy is always required after surgery

### **The PCL**

The Posterior Cruciate Ligament prevents the tibia from going too far backward beyond the knee joint. Injury may occur by a tackle from the front of the lower leg forcing it backwards. Emergency room doctors see PCL injuries when an unfastened driver in an automobile hits the dashboard of the car with their lower leg.

**PCL injuries are much less common in sports than ACL injuries. Once again MRI is the diagnostic tool, and often, but not always, surgery is the treatment.**



## **MCL**

The Medial Collateral Ligament is the most commonly injured ligament at the knee joint. Its function is to prevent the knee joint from going too far medially. Tackles from the lateral side may surpass the MCL's ability to stop motion and it can slightly or completely tear. It is partially connected to the medial meniscus, and thus the exam can be confusing whether the medial meniscus is also involved.

Athletes complain that the knee feels unstable and if able to walk, the athlete may complain of medial pain when bending the knee.

A good exam is sometimes all that is needed to diagnose this injury, although MRI is often done to ensure other injuries are not also found.

There are three grades of MCL sprain. **A grade I** has a laxity and discomfort when stressed. Soccer players often have Grade I MCL sprains due to a tackle or frequent passing/straining the inside of the knee. Three to six weeks of rest ensures returned strength. Physical therapy often hastens recovery shortening the amount of time needed to rest and reduce the chance for recurrence.

**A grade II and grade III sprain** have more significant tears, bleeding, swelling, and pain. This causes a more obvious injury and therefore more obvious inability to run, cut, and jump. A grade II and grade III injury may take six to twelve weeks to heal, and a knee immobilizer or MCL brace will protect the area so the athlete will not continue to stress the injured ligament. Even when the athlete returns to

sport an MCL brace is commonly used for a period of time. Linemen on some football teams may use the MCL brace as a protective brace, even if never injured.

Treatment is almost always time. Six to eight weeks typically allows the MCL recovery, and physical therapy assures the MCL has the ability, strength, and proprioception to return to sport. Surgery is rarely needed for an MCL tear by itself.

Surgery on a knee injury, such as an ACL tear, used to occur as soon as it was found, but surgeons learned that post-operative recovery was slow and tedious. Now, even high-level athletes may be allowed to heal the MCL (two to four weeks) before other ligaments, such as the ACL, are operatively managed. This way, the knee is stronger, and recovery time is shortened.

## **LCL**

The lateral collateral ligament is the ligament preventing excessive lateral movement when the knee is struck from the inside. It is connected from the femur to the fibula and has no connection to the lateral meniscus.

Athletes complain that the knee feels unstable and if able to walk, the athlete may complain of lateral knee pain when bending the knee.

Exam is often all that is required to diagnose this injury, but MRI is often done to ensure other areas of the knee are also not injured.

There are several grades of sprain. **A grade I sprain** has a laxity and discomfort when stressed. Three to six weeks of rest ensures returned strength.

**A grade II and grade III sprain** have more significant tears, bleeding, swelling, and pain. This causes a more obvious injury and therefore more obvious inability to run, cut, and jump. A grade II and grade III injury may take six to eight weeks to heal, and a knee immobilizer will protect the area so the athlete will not continue to stress the injured ligament.

Treatment is almost always time. Six to eight weeks typically allows the LCL recovery, and physical therapy assures the LCL has the ability, strength, and proprioception to return to sport. Surgery is rarely necessary for an LCL injury alone.

## **Medial and lateral meniscus**

The meniscus is a cartilage made pillow type structure, padding the femur from the tibia. The medial and lateral meniscus are different shapes but for simplicity, think of them as “C” shaped shock absorbers, preventing the bones from grinding upon each other during flexion and extension of the knee.

An injury that traps the meniscus in between the femur and tibia can cause a tear. This is commonly seen in football when an athlete is tackled, and falls to the ground with the knee twisting. Snow skiers may also injure their meniscus with a twisting injury during a fall.

Meniscus injuries are not as common as MCL injuries. Some people have a small meniscus injury and don't seek assistance from a doctor. A second injury, months or years later, cause the first injury to tear more and the patient is forced to seek care because of pain, locking, or snapping.

A tear can be so small that the meniscus can continue to pad the area, or so large that it causes a flap and obstructs the normal movement of the knee. This "bucket handle" type tear can cause knee locking. The athlete may state they can't completely straighten or bend the knee. Stair climbing causes the knee to give out, and running is fine for several steps and then there is a sudden onset of pain and clicking. In each circumstance, the athlete is describing the injured meniscus "getting in the way" of normal knee movement.

Once again, the exam is sometimes all that is required for diagnosis, although MRI is often done to prove the diagnosis and ensure other areas of the knee are not injured.

Depending on location of the meniscal tear, surgery is often the best option. In young children, a small tear at the front of the meniscus is sometimes watched, as blood flow may be enough for some healing. Most teenage and adult patients, and anyone with a large tear, or posterior tear (in the back of the meniscus as there is decreased blood flow needed for healing) are surgically treated.

After repairing or cleaning out a torn meniscus, the athlete can enter an aggressive physical therapy program and often return to activity in three to four weeks (with more aggressive surgeries requiring two to three months of therapy) and competitive sport soon afterward. Surgery is never good news, but meniscus surgery is relatively straight forward and there is a faster return compared to the longer ACL or PCL recovery. Not doing surgery to a significant meniscus injury as an adolescent risks arthritis and other poor outcomes as an adult.

### **The Combination injury**

While athletes come into the office with isolated injuries- such as an MCL injury, or medial meniscus tear, it is common for multiple areas to be injured after a tackle or fall.

Football players have the dreaded "**terrible triad**" which is an **ACL tear, medial meniscus tear, and MCL tear**. This occurs after a tackle from behind and the athlete falls to the ground twisting the knee.

MCL tears are often associated with other injuries:

MCL + ACL

MCL + medial meniscus

MCL + ACL + medial meniscus (“terrible triad”)

With any of these injuries, the MRI will almost always show a “bone bruise” on the femur or tibia. This results from the impact of the tibia on the femur during the injury. Time is the treatment for this injury. It is obvious proof to the doctor how much force was present during the injury.

### **Other Knee Problems**

It is not possible to explain every entity of the knee, but you should be exposed to a few other problems.

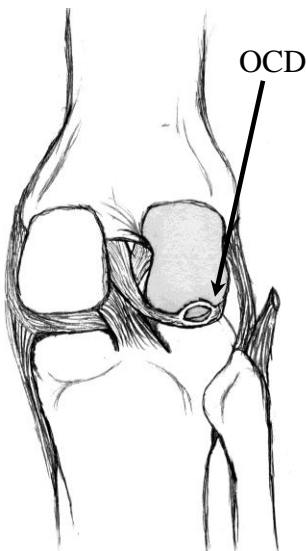
#### **The Plica**

A plica is a synovial fold of tissue that disappears before a child is born in most instances. Sometimes though, the plica remains and becomes an unnecessary, useless part of the knee. There can be up to four plicas although the medial plica is the one that can cause pain.

If the plica gets inflamed, it can cause pain and may be felt by the examiner. It feels like a rubberband-like cord that is tender when rolled over by the examiner’s thumb. Treatment typically involves ice, massage, and relative rest. Rarely, the plica becomes such a chronic issue, that consideration can be made to have it surgically removed.

Occasionally it can be mistaken for ACL type pain, and although the MRI does not show an ACL injury- a frustrated surgeon (and patient) may go to surgery to look for a tear- and find an inflamed plica (which is removed).

#### **Osteochondritis dessicans**



Osteochondritis dessicans (OCD) is found in the knee, elbow, or ankle. When in the knee, it is seen at the femoral condyle by x-ray.

Possibly congenital (since birth), after overuse, trauma, or possibly for an unknown reason, a portion of bone is not allowed enough blood flow. The bone becomes “ischemic” (the lack of blood flow causes a lack of oxygen to the bone) causing no symptom to the patient or possibly subtle pain. There is no problem with knee movement or strength in the beginning. Swelling,

limp, and decreased range of motion may follow after a period of months.

If the problem persists, the bone not receiving blood flow can break away from the healthy bone and become a free floating piece of debris in the knee joint. This piece of bone can cause pain and knee locking if it gets in the way of normal joint movement. An x-ray can identify this loose body.

An MRI is often performed to see the extent of the problem. An attached lesion may have fluid surrounding it- suggesting a more advanced stage of OCD than an attached lesion without fluid surrounding it. A completely detached lesion in the joint can be more accurately sized to make decisions on treatment.

If the lesion is attached and there is no fluid surrounding the OCD area, rest is almost always the treatment. If the athlete continues sport, the OCD lesion most certainly will advance.

If the lesion has fluid surrounding it, the doctor may be more careful, immobilizing the area along with rest from sport. Follow-up can be accomplished with x-ray or MRI.

If the lesion has already broken off from the healthy bone, decisions must be made on what to do with this floating foreign body. If it is large, a surgeon may attempt to pin it back to the healthy bone and attempt to save it. If it is a small piece of bone, it may be arthroscopically removed.

Some surgeons believe that drilling holes in the injured area- causing bleeding, and hopefully a return to normal blood flow to the area is one option if rest alone is not helping. Other options include simply leaving the defective bone alone.

Physical therapy almost always follows the treatment- whether rest or surgery to ensure normal movement.

This problem should be dealt with by a surgeon comfortable with OCD and athletes. In fact there are doctors that base much of their practice on this type of injury at the knee or at the elbow.

### **The Dislocated or Subluxed Patella**

A dislocated knee cap must be put back in the correct position with manipulation by a trainer, the injured athlete, or a doctor. A subluxed knee cap also leaves the correct position, but quickly returns by itself without manipulation. Both can cause severe pain, swelling, a bone bruise at the lateral femur and medial patella (kissing bone bruise), a tearing of the medial femoral patellar ligament (what holds the patella from going too far laterally), and in some cases can “break” a piece of cartilage off under the knee cap. Xray, MRI, and a TTTG measurement can be helpful in diagnosis as well as suggest risk of recurrence. Rest for two to four weeks, physical therapy, and a stabilizing brace during sport can be tried after a first occurrence. Recurrence is very common though, and surgery should be considered to “tighten down” the patella after a subsequent episode.



# Groin and Hamstring Strains

Groin strains and hamstring strains are common. The worst part of this diagnosis, in my opinion, is their high chance for recurrence. So many athletes with a groin strain improve, only to find that they reinjure the same area several months later.

Runners, gymnasts, soccer players, and dancers are at particular risk. Athletes during a growth spurt are also be at risk. Stretching may make the athlete more flexible, but it is unlikely to prevent injury. Most literature suggests the best warm up is a jog for five to ten minutes, followed by a light stretch, then a full practice. Conditioning and strengthening can occur during practice and warm down can include a light stretch. Ballistic stretching (bouncing) is discouraged, while static stretching (no bouncing) or pulse stretching (a tiny movement back and forth but not a bounce) is considered safer. Having another person stretch you, such as the coach or parent, is helpful to obtain your flexibility goals, but over-stretching can cause injury.

## **RULE OF THUMB:**

Stretching absolutely increases flexibility but possibly does not decrease injury (this is controversial).

A good warm up, such as a five minute run is just as important, possibly more important, than stretching. Stretching at warm-down is best.

Even with a perfect warm up, practice, and warm down, athletes injure their groin and/or hamstring. It can be something as unfortunate as an uneven surface such as a hole in the soccer field. It may be a quick pivot, a change in stride, or just a bad day. The athlete may state they heard or felt a pop and sometimes explain they feel a warm sensation followed by pain.

Weakness is a typical finding along with pain and the inability to run. Stretching the injured muscle may cause severe pain, and testing the function of the muscle by an athletic trainer can assist in localizing which muscle is injured. Occasionally an athletic trainer, physical therapist, or clinician can feel a defect in the injured muscle, similar to a divot on a golf course. This “divot in the muscle” is usually repaired with time and physical therapy for strengthening.

Ice should be applied quickly. It can be used four times per day the first three days. Physical therapy is important- the quicker it is started, the quicker the athlete will return to practice.

Most importantly, and hardest to convince the athlete- exercises should be continued for months. The weakened area, even when pain-free, will benefit from proprioception, strengthening, and stretching. Re-injury is so common that the athlete should be told the likelihood, especially if exercises are not taken seriously or done sporadically, rather than daily.

Of all the injuries I see during a season, these injuries are the most frustrating. They are painful, cause decreased potential from the athlete, and often recur. They are slow to heal (as the athlete often attempts to continue sport while injured or fail to take physical therapy seriously) and slow to feel progress (the athlete often states they are seeing no benefit from treatment for the first one to three weeks!). The injury will heal, and physical therapy shortens the time expected for healing. Most importantly, after a groin or hamstring injury, emphasis of continued exercises is essential as re-injury is extremely common. Looking for the cause of the initial injury and possibly changing technique may reduce the likelihood of a recurrence.

If the pain is high (near the buttocks) or if after two to three weeks of therapy, there is little or no improvement, an x-ray and/or MRI may be justified to rule out an avulsion type fracture- when the tendon pulls off a small piece of bone at the point of attachment of the muscle to the pelvis. This is less common than a sprain- but when found, increased rest and prolonged therapy is required. Making the diagnosis can inform the patient, parent, and coach that the likely three to four weeks of therapy will not be sufficient and more patience will be required. Not doing the further investigation risks a frustrated and, at times, angry patient who can't understand why the "typical" therapy for a groin/hamstring strain is not helping as expected.

### **Hernias and "athletic pubalgia"**

When athletes have a "fullness", pain, or bulging in the groin, a medical provider should rule out a hernia. This is when an abdominal or pelvic muscle fails to hold the abdominal contents above the pelvic floor. Surgery is almost always required to avoid further problems. Hernias can be caused by straining from weight lifting, or less obvious causes such as an increased strain during a jump, a leap, or during a fall. They can occur in the abdominal wall (rectus hernia), the lower pelvis or in the scrotum of male athletes.(femoral and direct vs. indirect hernias)

A sports hernia or athletic pubalgia has been studied for some time. It too has a surgical treatment which is at times difficult to diagnose by exam and/or MRI. While most common in soccer players, it can be seen in an athlete from any sport. The surgeon should be well educated about this problem, and is likely the surgeon who works with the professional soccer team in your area- not the general surgeon who corrected your "grandfather's hernia". Think about athletic pubalgia in an athlete who has lower abdominal pain with exercise and no other diagnose can be found.

# Hip Pain

Hip pain during adolescent athletics is a less common complaint than ankle, foot, and knee pain- but one not to be overlooked. This chapter will be split into three sections- 1) hip joint involving the femur (the large leg bone), 2) outside the hip joint (soft tissue), and 3) miscellaneous.

An important note is that pain can be referred from the actual site to a distant site. Hip problems are often silent at the hip and felt by the patient in the knee- especially in young children. Thus knee pain- while typically a knee disorder- should alert the medical provider that a hip problem is a possibility.

## Referred Pain Examples in Children

<u>Site of Complaint Pain</u>	<u>Actual Area Injured</u>
Knee	Hip
Tooth	Sinusitis, Ear
Eye	Migraine Headache

## Referred Pain Examples in Adults

Shoulder	Gall Bladder, Heart
Jaw	Heart, Sinuses, Teeth

### RULE OF THUMB:

There are very few rules in medicine. And even when there is a rule- some doctors just don't agree with the other doctors. One of my rules is as follows:

**“No child should limp without a diagnosis made and a treatment planned.”**

Limping in adulthood has several possibilities- many benign (not dangerous). But in childhood, limping often is from dangerous causes and should be evaluated immediately.

Of course a sprained ankle can cause a limp and therefore the diagnosis is easily made and the treatment can be planned.

But hip problems also can cause a limp and many of those problems are serious, may result in surgery, or if not treated- may result in life long consequences.

## 1) Hip pain at the hip joint

The hip joint is made up of primarily the femur and the pelvis in close proximity to the coccyx (tail bone) and sacrum. Strong muscles and connective tissue help ensure the femur stays in the acetabulum (hip socket) even with recurrent stresses and motion such as running, jumping, and impact. The overall structure is so strong that dislocations and fractures are relatively uncommon even in football, ice hockey, rodeo sports, and snow sports. Automobile accidents and falls from large heights make up the majority of trauma to the hip in adolescence.

Thus sports interested providers are less likely to think of trauma when an athlete complains of hip pain. Instead the growth plate at the femur is a primary concern.

**Legg Calve Perthes Disease-** Repetitive stresses to the hip (as well as other factors) may cause a decrease in blood flow to the femoral head. Over time this can cause an area of bone deterioration called avascular necrosis at the femoral head or Legg Calve Perthes, or simply Perthes Disease.

Incidence according to some sources are most common in boys just before puberty. In my experience, it occurs in both boys and girls from seven to fourteen years old.

Pain at the hip or groin is a common early complaint, while limping and a reduced range of motion- especially external rotation of the hip- are later signs. Athletes may recall an accident, fall, or tackle that they relate as the cause- but most cases of avascular necrosis occur over time rather than one event.

X-ray may detect the problem, although bone scan and MRI are more reliable.

Treatment begins with rest and sometimes leads to complete bed rest. Less commonly, surgery may be necessary.

### **Warning Signs of Legg Calve Perthes**

Hip or groin pain lasting more than two weeks without known trauma

Reduced range of motion

Limp

### **Treatment Strategies for Perthes**

Rest- 5, necessary in almost every case

Chiropractic- 2, rest still required

Surgery- 0, not necessary in most cases

Medication- 0, unhelpful in this diagnosis

## Questions to ask the doctor

If the x-ray is normal, how long will you wait to get a bone scan or MRI- if the x-ray is normal and there is high suspicion- the next test should be scheduled relatively quickly.

Should a pediatric orthopedic surgeon be involved in following my child's case- typically pediatricians and family medicine doctors prefer to have someone well educated in this diagnosis- such as a pediatric orthopedic surgeon

### **Slipped Capital Femoral Epiphysis**

This problem also occurs at the head of the femur, but rather than at the edge, it occurs at the growth plate. The **“textbook case”** occurs in an overweight boy between eight and twelve years old. But SCFE can occur with either gender at any age while the growth plate is still open.

Once again, the symptoms are pain at the hip, groin, or referred pain to the knee and often with a limp. External rotation of the hip causes pain (turning the knee out while sitting). X-rays are almost always diagnostic. It is uncommon to need further studies, although the x-ray may be very subtle.

Treatment involves immobilization and surgery. A pediatric specialized orthopedic surgeon should always be involved in this situation.

### **Other Causes of Hip Pain in the joint:**

Rarely, **infection** can find itself “stuck” in the hip joint. Aspiration (removal) of the fluid is necessary to determine whether antibiotics or surgery should be used to take care of the infection. Untreated infections can cause devastating destruction to the hip joint. Fever, limp, and an ill appearing patient are clues that a septic hip infection may be the cause.

Transient synovitis is another cause of hip pain and limp, often without fever and the patient is less ill appearing than one with a septic hip. Diagnosis may require xrays and aspiration of joint fluid to ensure a septic hip is not the cause. Treatment is rest and pain medication. The result is always improvement.

### **Hip Pain outside the Joint**

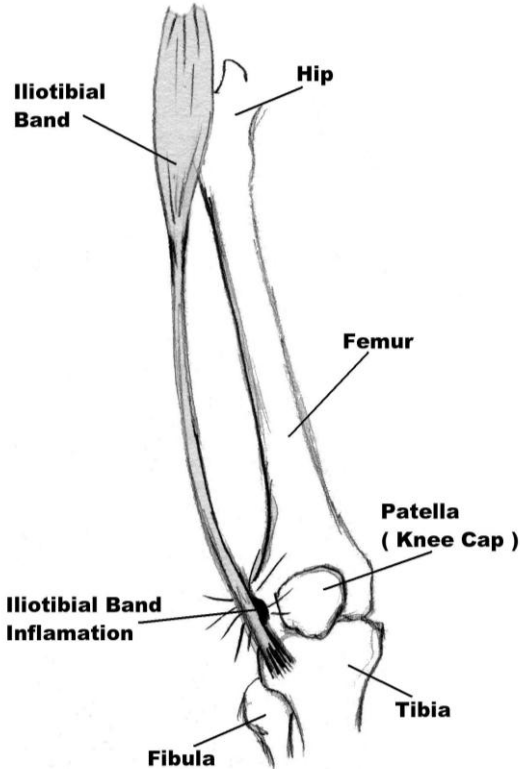
Hip pain can occur due to problems not involving the actual hip joint. Muscles and connective tissue in this area is large, strong, and when injured, obvious with every step an athlete takes. It can be severely debilitating to sport and every day life.

## **Iliotibial band syndrome**

Iliotibial band syndrome (Runner's knee) occurs in dancers, runners, and skiers. The tight "rubberband-like" structure is connected at the hip and knee. Somewhat flexible, it becomes irritated with excessive use and overstretching. Once inflamed, it causes pain with simple activities such as walking, climbing stairs, and jumping.

Pain is felt on the lateral side of the leg, often at one of the two connections. Physical exam is often all that is necessary and physical therapy is the best treatment.

Iliotibial Band Syndrome (ITBS)



### **Treatment Strategies- see page 7 for explanation**

Surgery- 0, never necessary

Chiropractic- 3, worth a try

Physical Therapy- 5, while not absolutely necessary, ITBS will "nag" an athlete until resolved.

Medication- 3, helps with inflammation while physical therapy is working on problem

Physical therapy identifies if there is a muscle in the hip region that is relatively weak and causing the IT Band to become overworked. It also assists the athlete in understanding what in the practice is exacerbating the pain and inflammation and what exercises may relieve the problem from continuing.

### **Groin Strain**

Groin pain may be a warning symptom of a hip problem, or simply a groin injury. The history is helpful in deciding along with a good physical exam. Rarely does there need to be a radiology examination and physical therapy is almost always the treatment. Pain and weakness often improve within two to three weeks of physical therapy. This, like hamstring injuries, often recur throughout one's sports career.

Avulsion fractures are less common than injuries to the soft tissue alone- but must be considered. During an injury, tendons (the muscle attachment to bone) may pull a small piece of bone away from its intended place- an avulsion fracture- resulting in pain at the attachment and pain lasting longer than predicted. If symptoms persist past two weeks, without much improvement, or the initial pain is high (buttocks if hamstring pain, "pelvis bone" if groin pain) an x-ray and/or MRI may be considered. While treatment remains physical therapy, more time to rest is warranted in the beginning of treatment.

### **Coccyx and Sacrum Disorders**

There are several problems that can occur at the sacrum or coccyx. These problems can cause tailbone, back, or hip pain. There are also possible complaints with going to the bathroom, sitting, and occasionally sleeping. A good history and physical exam is often all that is necessary. X-rays are sometimes helpful such as in a broken coccyx (tailbone)- other diagnostic tests are rarely necessary. Inflammation at the sacrum (SI joint pain) can be an early clue of arthritis or "spondyarthropathy". Laboratory tests (CBC, sedimentation rate, HLA B-27), xrays, and bone scans or MRIs are sometimes necessary to confirm.

#### **Treatment Strategies- see page 7 for explanation**

Surgery-0, almost never necessary, very rarely the coccyx (tailbone) is removed if it causes chronic problems with pain or going to the bathroom

Physical therapy- 3/4, sometimes helpful

Chiropractic- 3, once again, sometimes helpful

Rest- 4, this is often the best treatment along with a "donut" cushion

Medication- 3, helps with pain, while time often is necessary to relieve the problem such as a broken tailbone.

### **Other problems around the hip**

While uncommon in young athletes, the hip can be the site for problems other than musculoskeletal. These are unlikely and usually obvious serious problems.

- 1) **Infection- a septic hip** is a true emergency. It is often associated with a high fever, limp, inability to move the hip, and an ill appearing patient.

X-rays may be helpful, surgery and antibiotics are necessary and an orthopedic surgeon along with an infectious disease specialist should be involved.

**Transient synovitis of the hip-** typically following a virus- can mimic the more dangerous septic hip- with pain, limp, and fever. A medical professional is necessary to determine the difference, as a septic hip often requires surgery and transient synovitis requires only time and pain medication.

**The clue here is that the patient LOOKS SICK-more so with a septic hip than with TS- neither have a history of injury. Labs, x-ray, a good history and physical exam, and sometimes aspiration of the joint (removal of fluid from the hip) is necessary to make a diagnosis.**

- 2) **Arthritis-** arthritis is thought of as an adult problem but child onset arthritis does occur in thousands of children and can be considered if pain occurs at large or small joints in the child.

X-rays may be helpful, some blood tests are helpful, and an excellent history and physical is often compelling. Pediatric rheumatologists should be involved.

Arthritis symptoms may also occur during an infection such as strep throat or a virus. This “reactive arthritis” should be evaluated to rule out the need of antibiotics versus watching alone.

- 3) **Stress fracture-** occasionally found with x-ray, better diagnosed with MRI. Rest is the treatment, sometimes non-weight bearing (with crutches). Physical therapy and a search for the reason it occurred is necessary before return to sport. Some causes are poor nutrition, hormone deficiencies, overtraining, poor technique, metabolic problems such as a low vitamin D or thyroid problem, and as a last consideration- “bad luck”. A cause for recurrent stress injury must be found and not simply blamed as “bad luck”. Lab tests, bone density exam (DEXA), and a nutrition evaluation can be helpful in detecting an untreated problem resulting in more than one stress fracture.

- 4) **Tumor-** Not common but benign and malignant tumors can be found around the hip and is an important reason to have doctors involved with the diagnosis rather than having coaches and parents alone manage the pain. Unicameral bone cysts and fibrocortical defects



may be located near the hip and cause a “pathologic fracture” of the hip if very large.

Older people “break their hip” during a fall or simple task because their bones are weak due to osteoporosis or severe arthritis.

Children “break their hip” because of a weak point or severe trauma such as a large fall or automobile accident. That weak point may be a cyst, tumor, or infection that is hidden until a simple fall or task causes a severe injury which is unexpected and even surprising for the actual incident.

I know you just stopped reading because of the last paragraph! Cancer is rare- but a reality in adolescence. Almost all athletes with pain have a sports injury and nothing more. It is still important to have a doctor involved though. The coach and enthusiastic parent pushing for the next competition are almost always correct in saying, “a little pain is not bad”, or “you have to work with a little pain”, or “we can rest at the end of the season”. It is not the job of the parent or coach to think of the tiny percentage of patients that have something other than a sports injury. But your doctor does have this in mind and it is paramount that while the coach is pushing for athletic success, nothing more serious is missed.

**It is the doctor’s job to help you with the common injury and not miss the uncommon one. Let your child’s doctor do their job.**

Parents do NOT need to go looking for these problems- or lose sleep for fear of one. Instead- common sense and a little education is all that is necessary to ensure your child is safe.

**Warning Signs for NON musculoskeletal causes of hip pain**

- Fever, night sweats along with hip pain
- Loss of weight along with joint pain
- Limps should always be evaluated although typically are due to musculoskeletal causes
- Large (above one inch) lymph nodes in groin

**Case I:**

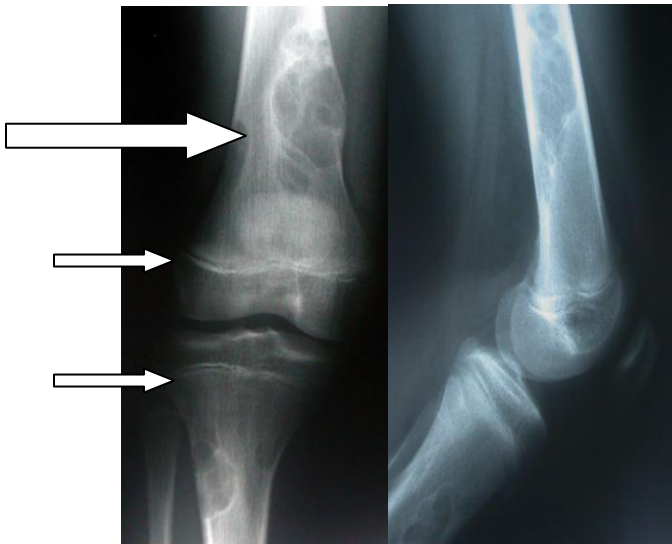
A twelve year old gymnast is swinging on the uneven bars. She jumps off the low bar- as she has hundreds of times before- only this time she falls to the ground crying in severe pain. She cries out that it is “10/10 pain” and an ambulance is called. The coach calls the parent on the telephone and explains

that he doesn't know how the injury could have occurred – as nothing appeared to go wrong.

X-rays show a fracture at the femur and MRI shows a cyst at the fracture. A surgeon “biopsies” the cyst and there is NO cancer.

This benign cyst has most likely been there for years with no evidence of pain and has finally caused a weakness at the site. There would have been no way to predict the timing of the injury and unless an x-ray had been taken of the hip for some other reason- and the cyst would have been found incidentally, there is really no reason for the child's doctor, parent, or coach to go looking for this possibility.

Surgery and immobilization are done and eventually physical therapy. The athlete is allowed to return to sport the next year.



This is an example of a benign (non-cancerous) cyst (the larger arrow) in the lower femur, near the knee. There is a smaller lesion in the tibia at the bottom of the x-ray. Although these lesions typically stop growing once the patient stops growing (notice this patient is still growing, see the growth plates marked with the smaller arrows), this patient's lesion had gotten large enough to risk weakness in the bone. Surgery was done, before a pathological fracture could occur (which can not be absolutely predicted)

Normally though, these benign lesions are found by accident- while xraying an extremity for some other reason. If small they are safe to watch- without any treatment required at all.

# The Back

The back is incredibly complex. Neurosurgeons and back specialized orthopedic surgeons continue to invent new hardware to correct back disorders. Surgical remedies for back pain are still not 100% and excellent surgeons advise their patients to “do everything” before resorting to surgery. Exceptions to this include neurologic (nerve) problems and acute injuries requiring immediate surgery.

Thankfully, most cases of back pain are not so threatening- although they remain debilitating, and sometimes are season, or worse, career ending.

This chapter will be separated by acute injury and chronic injury. Acute injuries are scary, must be dealt with extraordinary care, and can be life altering depending on the outcome. Chronic injuries are often a nuisance, can go on for years without diagnosis, and are dealt with differently depending on the doctor the athlete chooses- a chiropractor, an orthopedic surgeon, a neurosurgeon, or a general practice doctor.

## ACUTE BACK INJURY

Thankfully, neck and back injuries are not common injuries- but they are potentially career altering and in some cases- life altering injuries. Athletic trainers, sports medicine doctors, and emergency medical personnel are best trained to deal with these emergencies, although are rarely present at the time of injury.



### RULE OF THUMB:

If there is a question of neck or back injury- don't move the athlete - and call 911. This is a case where it is better to be safe than sorry.

A neck or back injury is a time to over-react and risk looking “foolish” for over reacting - because the injury was not as bad as first thought. Over-reacting and calling an ambulance in this case is better than the alternative of moving an athlete- causing worse damage, possibly even paralysis- and regretting the decision later. Any time an athlete complains of tingling, numbness, weakness, or paralysis- get help.

Even as a physician, I have called 911 during a sports event, because the patient was describing evidence of a neck injury that may have injured the spinal cord. Keeping the athlete safe until x-rays can show the extent of the injury is always the correct answer- regardless of your job title (coach, parent, doctor) and regardless of your experience (first time you have seen a back injury or the fiftieth time you have seen a back injury). The patient can not make good decisions

immediately after an injury- and you may be the only person between the typical muscular injury and the rare but life changing neck fracture with impending paralysis on the next movement.

### **Diagnosis of injury to back and neck**

There are clinical ways to help decide if there is muscular injury versus bony injury. A doctor on the side lines may be comfortable moving the patient.

For the purposes of this book though- if there is an injury that appears life-threatening or is followed by numbness, tingling, weakness or paralysis- don't move the patient and call 911.

X-rays and MRI are key diagnostic tools and although physical exam by a doctor is important- often the radiographic evidence makes the decisions for the patient.

### **Exceptions to the rule:**

Stingers (or burners) cause weakness and tingling in the arm and in the presence of an athletic trainer, physician, or physical therapist- the athlete may not need immobilization or an ambulance. A trained professional should make this decision, not the enthusiastic athlete who desires reentry to the game at any cost.

**SEE SHOULDER CHAPTER**

Potential injuries:

- 1) fracture- the most feared injury is a fracture of the spine causing injury to the spinal cord. These injuries often result in partial or complete paralysis. Moving a patient with a fracture can result in further movement of the fractured bone and cause more injury to the fragile nerves just millimeters away. Immobilization and professional transport to an emergency department for x-ray is essential.
- 2) Ligament injury- these injuries occur with the same mechanisms as bony injuries and can cause similar symptoms. Some severe ligament injuries allowing excess movement of the bones it connects to can also injure the spinal cord. Similar action is necessary and while x-rays are done- MRI is often required to diagnose this injury.
- 3) Muscular- injury to muscles around the neck and back are most common and least dangerous. During an accident though- it is difficult- even for medical professionals- to guarantee the injury resulted in only muscular trauma. If a ligament or bone is also involved- the muscles may try and

protect the area by spasm and over-reaction. The observer may feel this muscle spasm at the athlete's neck and mis-interpret this as a muscular injury while in fact it is the muscle attempting to protect the bone or ligament injured. Moving this athlete would be a horrible error. Thus if there is any question at all- keep the patient from moving and call an ambulance. X-rays and possibly CT or MRI will guarantee the athlete's safety.

### **Validity of Tests after an accident**

Vibration of bone -0- a tuning fork vibration placed on a bone which results in pain is a test for fracture rather than muscle injury- it is not 100% accurate, and while possibly acceptable for clarifying an injury to the ankle or foot on the field, it is completely inappropriate for judging safety in moving an injured athlete after a neck or back injury.

Midline pain and strength testing of hands and feet- 3-A physician's physical exam at an accident can make judgments of safety with a physical exam. While not 100% accurate, it is safe to move an athlete with proper training. **It is never safe to move an athlete with an untrained examiner making decisions based on evaluating midline tenderness or testing of grip strength.**

Symptoms-5- Any symptom of weakness, burning, tingling, paralysis, "lightening sensations" or spasm should be taken seriously. Injury to the spinal cord is commonly life-long- so mistakes must be avoided. Call for help. Athletes can still have injury without symptoms- so if an athlete moves after an injury and then begins to have symptoms- lay them back down, immobilize them and call for help.

X-ray, CT and MRI -5-key diagnostic tools.

Regardless of how an athlete is laying- keep them still until professional help arrives. The only exception to this rule is if the athlete is also not breathing. Then the most trained observer should take over with spine immobilization and first aid/CPR. Therefore if the athlete is injured face down, or in a gymnastics foam pit, or on a football field- keep the patient from moving until professional medical personnel arrive. Not only do they have more experience moving injured patients, they have more equipment such as neck braces, spine boards, and proper transportation. **It is never appropriate for an untrained person to attempt placing a neck immobilizer on an injured athlete!**

**Moving a patient to continue the game, keep the clock running, stay on schedule during a tournament, keep from making the crowd worry, prove to the athlete that he is not injured, please a parent or coach, or any other reason- is dangerous, a possible law-suit, and most importantly- a possibly paralyzed athlete. Don't do it.**

# CHRONIC BACK AND NECK PAIN

Chronic back pain is a common problem in almost every adolescent sport. Once an athlete has a back injury, it is often slow to heal- as the back is used in almost every motion during practice, competition, and even daily activity not associated with sport. It is frustrating for both the athlete and the coach as time and skill progression is halted for an injury that is a nuisance and often one that is poorly treated by the medical community as a whole. This chapter will describe some treatable causes for back pain. Most cases though go without a particular diagnosis and either pain decreases over time or cause the athlete to change sport.

Diagnosis often begins with x-rays. They are typically normal and while some athletes proceed to CT scan or MRI, most are told by their medical providers to rest. Chronic back pain is truly a pain because rest is sometimes the right treatment- but also “seems like a waste of time” causing frustration to everyone involved.

Treatment for back pain may be the most varied. This is because no medical professional has the magic treatment that works for everyone. Thus providers from several backgrounds attempt to heal the hurting. Some studies suggest that no matter what a patient does, back pain gets better about fifty percent of the time. Physical therapy, chiropractic, acupuncture, medication, injections, and other alternative therapies not listed have about the same success. So how do you choose? Most patients end up at the provider they feel most comfortable- and likely that is the right place to go. Pro-chiropractor patients get manipulation and adjustments while pro-physical therapy patients get massage, exercises, and conditioning. Each has about equal success.



**If the treatment seems too good to be true... it probably is!**

The truth is no provider is 100% successful at treating back pain. Often the diagnosis can not even be found. Surgeons often advise to “try everything” before resorting to surgery because that isn’t even always helpful. Pain relievers, muscle relaxants, electrical stimulation, whirl-pool, TENS units, steroid injections, and a dozen other treatments can be tried- and one patient will find relief while another can find nothing to help.

Some medically trained providers offer relief and help- non medical providers realize that there is no perfect treatment. Patients that are desperate may try anything to return to sport, work, school, and normal life. While some therapies are unproven by medical studies- they are suggested to be effective and have evidence in non-scientific journals. While not medically approved- they may indeed help and an open mind should be practiced when it comes to back pain.

On the other hand-providers offering only testimonials without any studies should be carefully questioned. What worked for one, doesn't mean it will work for another. People take advantage of others in pain desperate for the "magic cure". **If claims and testimonials seem too good to be true- it is likely to be a gimmick and worth not wasting money and time.** Ask for studies, the number of people treated, the risks involved, and the organization the provider is a member of. People interested in money rather than the patient's well-being have several things in common.

**Be careful with treatments that have a "Magic Potion" Promise**

- 1) **Treatment with no risks- these are also likely to have no benefits! Every medical treatment has risks, even ice therapy, but the risks are hopefully less than the benefits.**
- 2) **The provider has no proof except what another patient says- testimonials are extremely convincing but often based on placebo theory or are just plain untrue or unique to one person's experience.**
- 3) **The provider is not a part of a national organization- and possibly also not a health care provider at all- but a salesman with one thing in mind... money!**
- 4) **Treatment that helps multiple complaints such as fatigue, back pain, headache, rashes, etc... most proven treatments are proven for one thing. Those treatments that "fix" everything are likely working on nothing at all.**
- 5) **Treatments that are expensive or require multiple visits- most chiropractors and physical therapists (reasonable choices to treat back pain) today give you a schedule with the expected number of visits before you are feeling better- or advise you at that time to return to your doctor for further workup. Providers offering no end to the number of visits, the amount of money needed, or the goal of therapy need a second consideration- especially if they have you sign a contract**

**Alternative therapy can be good therapy**

Chiropractic	Acupuncture
Osteopathic manipulation	Massage therapy

I am not suggesting the patient should be close minded or only use Western Medicine- back pain truly has been "cured" by acupuncture, manipulation, and other "non-standard" treatments. On the other hand, people realizing you are in pain may attempt to "cure" you with nothing more than your desperate "hope" and while some people truly get better with this approach- it is NOT treatment that is better than placebo (about 40-50% successful in most studies) Therefore, desperate patients, willing to pay their entire life savings in hope of a "magic cure" that doctors could not accomplish- the people offering the "magic cure" may do nothing more than drain your bank account- leaving you with continued back pain and increased frustration, as well as disappointment and mistrust. Finding a treatment that is over 50% successful may be worth the time and money, while

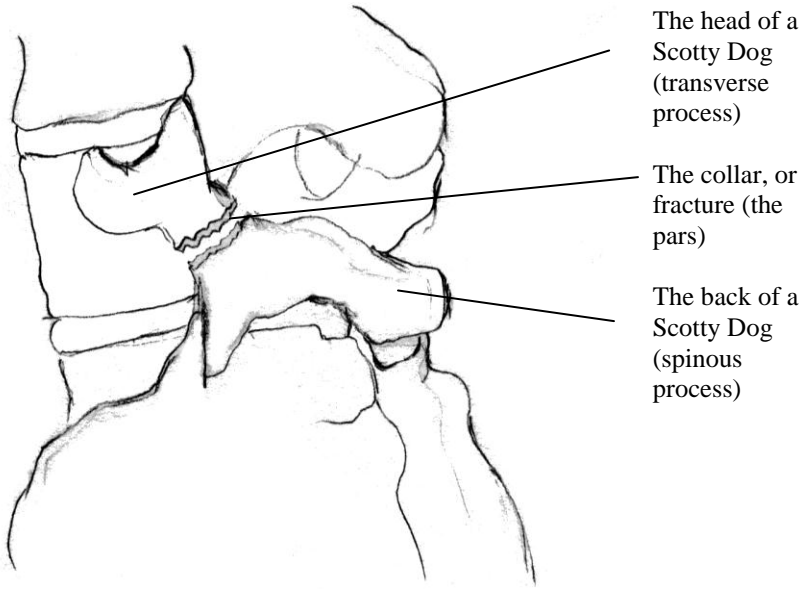
choosing a treatment that has no statistics other than the five people giving testimonial credit on a brochure may not be the best choice except to the salesperson depending on you for their commission! If their statement is, “Western Medicine does not tell you this works,” it may be because it **doesn’t!**

### **Treatable Causes for Chronic Back Pain**

#### **Spondylolysis**

This is one of the diagnosis specific causes of chronic back pain. It is most commonly found in gymnasts, linemen on the football team, and divers. It is often called the “Scotty Dog fracture” because of how it looks on an oblique xray. The cause of this stress fracture in the low back is controversial. Some experts believe it is genetic, or congenital, and the athlete is born with an increased weakness at the pars interarticularis of the lumbar spine, most commonly at L4 or L5. Since the weak area was there since birth, the sport does not cause the fracture, only the symptoms, when the area is irritated. Other experts believe it is not from birth but is developmental (isthmic), from the sport causing the fracture due to repeated hyper-extension activity at the pars, a relatively weak area during growth. There are other less common causes as well including traumatic and pathologic. In any case, athletes complain of dull low back pain worsened during extension skills such as front handsprings in gymnastics and rising into the tackle in football.

#### **Spondylolysis, the Scotty Dog Fracture**



Athletes can continue in sport for an entire season and sometimes for years. Finally an investigation may reveal the fracture with x-ray although typically an



MRI, bone scan, or CT scan must be ordered to reveal the injured area. **CT scan and bone scan are considered the gold standard for diagnosis.**

Treatment is normally rest from extension injuries and if the fracture is believed to be a new injury, back braces are commonly used. If the injury is believed to be old, the back brace is unlikely to help. Braces vary in size and shape. They are worn for two to three months and almost always relieve the pain but only sometimes cause the fracture to heal. The purpose for bracing is to force rest and ultimately pain free activity rather than proof of bone healing.

When both sides are fractured there is risk for the segment involved to slip forward- this slipping is called spondylolisthesis. This is a more ominous diagnosis and must be watched more closely as too much slippage must be surgically halted with fusion and hardware. The slippage is graded 1-4 and can be easily diagnosed with x-ray. Thankfully most are grade 1 or 2 (less than 50% forward slippage and can be simply watched and treated conservatively). Grade 3 and 4 typically require surgery as will the grade 2 that doesn't improve with bracing and rest. Rarely the bone can slip "off" the spine- spondyloloysis and is a relative emergency requiring immediate surgery. All forms of spondylolisthesis should be followed by an orthopedic surgeon comfortable with the back.

Ultimately, a "normal" x-ray does not rule out these diagnoses. Thus continued pain in an athlete may require bone scan, CT, or MRI to determine if a treatment is necessary.

**Born with an old injury, unlikely painful**      **New injury or healing stress injury, likely painful**

<b>CT</b>	<b>Positive</b>	<b>Positive</b>
<b>Bone Scan</b>	<b>Negative</b>	<b>Positive</b>
<b>MRI</b> (some argue not as good for this diagnosis)	<b>Negative/ Equivocal</b>	<b>Positive</b>

### **Sprain/Strain**

A back sprain or strain is a vague diagnosis explaining the injury at one of the muscles or ligaments around the back. The majority of muscles in the back are large, strong, and difficult to rest- as they are related to almost every movement in daily activity. The sacro-iliac joint for example causes back pain resulting from an imbalance or strain of muscles or ligaments in the back/hip area. Rest is the primary treatment and difficult to arrange with school, work, and sport. Medications are moderately helpful and physical therapy, chiropractic, and

massage appear to have similar outcomes. Injuries can take from two to six weeks to resolve regardless of the treatment chosen. Smaller muscles in the back can have spasm or sprain and result in as much time off as a larger muscle injured.

**Treatment strategies- see page 7 for explanation**

Medication- 3 nonsteroidals may help and muscle relaxants are equivocal

Chiropractic- 3 some think very helpful

Acupuncture- 3 some think very helpful

Physical therapy- 3 some think very helpful

Surgery- 0- not necessary

**Warning Signs**

Numbness, tingling, or weakness in the arm or leg

Problems with going to the bathroom

This points towards a disc or nerve problem- and yes, it can occur in children

**Disc problems**

Disc herniations are more common with adults but do occur in children. A trauma such as a fall or heavy lift may cause symptoms but disc injury can occur without recalling a specific event.

Symptoms include tingling, numbness, or weakness of the arm or leg. More severe symptoms include difficulty going to the bathroom or the inability to move the arm or leg normally.

Diagnosis is best accomplished with a good physical exam and typically an MRI. Treatment often is successful with rest alone. Chiropractic, osteopathic manipulation, physical therapy, and other modalities are possible treatments. This is a diagnosis where surgery is helpful but rarely necessary in adolescents.

**Scoliosis and Kyphosis:**

Scoliosis (a curved spine) and Kyphosis (a “hump back” spine) are common in adolescence. Growth spurts are the most common time for rapid change in curvature and a subtle curve may become unsightly during this time. Typically there is no pain associated with the curve unless it is extreme. Careful observation is all that is necessary in most cases and a good physical exam and x-rays are often the only management necessary. Chiropractic treatment and physical therapy are not thought to alter the outcome. Most scoliosis and kyphosis halts before the need for bracing or surgery- regardless of treatment!

Adolescent scoliosis is more common in children with parents who also had scoliosis and seems to be equal in males and females but more often progresses in females. It is termed idiopathic scoliosis as we are still uncertain of its cause. Bracing is the treatment if above 20-25 degrees (especially if the patient is still growing) and/or surgery (above 40-50 degrees) is discussed. While bracing

typically slows down the progression, only surgery can truly halt it with fusing the bones. Surgery is discussed with only large curves. An orthopedic referral should be considered with x-rays reading curves above 20 degrees in athletes that have not reached their final height. Different numbers are given including the “Cobb angle” and the “Risser score” to follow the progression of the curve and the maturity of the patient.

Kyphosis is also treated with a brace if extreme. Scheurmanns syndrome may be the diagnosis if 3 vertebrae show kyphosis with or without Schmorl’s nodes (the appearance of a “bite” taken out of the body of the vertebrae, actually the “end plate” of the vertebrae is disturbed due to the kyphosis). Pain can be associated with this problem in more severe cases.

More ominous causes of scoliosis are less common but should not be overlooked such as a tumor, neurofibromatosis, and other syndromes.

### Scoliosis



#### **What to ask your doctor about back pain**

If x-rays are unhelpful- would another test help to diagnose things such as MRI, bone scan or CT scan? When should I consider this next test?

If complete rest is not an acceptable option for me- what other treatments could you suggest?

After the proposed time you suggest, who is the next specialist you would advise I see- if I am not feeling better?

**Treatment Strategies** see page 7 for info

**Medication**- 0- usually not helpful in disc herniation, stress fracture, or scoliosis, may be helpful in a strain or sprain

**Surgery**- 4- helpful in some cases but not always necessary for stress fracture (spondylolysis/spondylolisthesis) unless large slip, or disc herniation unless not improved with rest, and not for scoliosis unless over 40-50 degree angle

**Chiropractic**- 3 worth a try before surgery for disc herniation unless severe nerve impingement, unlikely to help stress fracture or slow progression of scoliosis

**Acupuncture**- 3 worth a try before surgery in disc herniation unless severe nerve impingement, unlikely to help stress fracture or slow progression of scoliosis

**Physical therapy**- 3 worth a try before surgery for stress fracture (spondylolysis) and disc herniation unless severe nerve impingement, unlikely to slow progression of scoliosis

**Rest**- 4 typically helpful for stress fracture and disc herniation, unlikely to help scoliosis

**Bracing**- sometimes helpful in more severe cases of scoliosis or a stress fracture (spondylolysis,spondylolisthesis), not used in most cases of disc herniation

**Thoracic Outlet Syndrome**

This relatively rare problem is difficult to diagnose and sometimes more difficult to treat. Some physicians simply refer to surgeons or neurologists more interested in the problem rather than try and deal with it themselves. Athletes complain of pain in their neck, elbow, and sometimes into their hand. Tingling, throbbing, or stabbing pain after activity is normally the presentation. An extra rib (cervical rib), improperly shaped rib, or an anatomic barrier getting in the way of a nerve or blood vessel causes the symptoms.

Xray, CT, MRI, nerve conduction studies/EMG, and special tests like angiography are used, and sometimes fail to explain the symptoms. Physical exam showing muscular changes in the neck or trapezius muscles can be helpful along with Adson's test and other maneuvers trying to prove a change in circulation depending on the athlete's position.

Treatment involves change in technique or position with braces, physical therapy, neural stretching techniques, and in some cases surgery.

# The Shoulder

The shoulder is the most mobile joint of the human body. It therefore has a tremendous risk for injury- especially overuse injury. Consider the premier level swimmer, baseball pitcher, or male gymnast on the rings. In one month, each athlete has thousands of repetitions, and thousands of opportunities for potential injury.

## **Anatomy:**

The shoulder is made up of three basic bones, the clavicle (collar bone), the humerus (arm bone) and the scapula (wing bone).

It is made up of several connecting areas- the glenohumeral joint, made up of the humerus (arm bone) and the glenoid (shoulder socket), which is the most important. This socket is shallow, allowing for a range of movements but also the possibility for dislocation (or subluxation- dislocating briefly and automatically relocating without manipulation or reduction necessary).

The acromioclavicular joint is the site of an **AC separation**, most commonly seen in football or soccer due to landing on an outstretched arm.

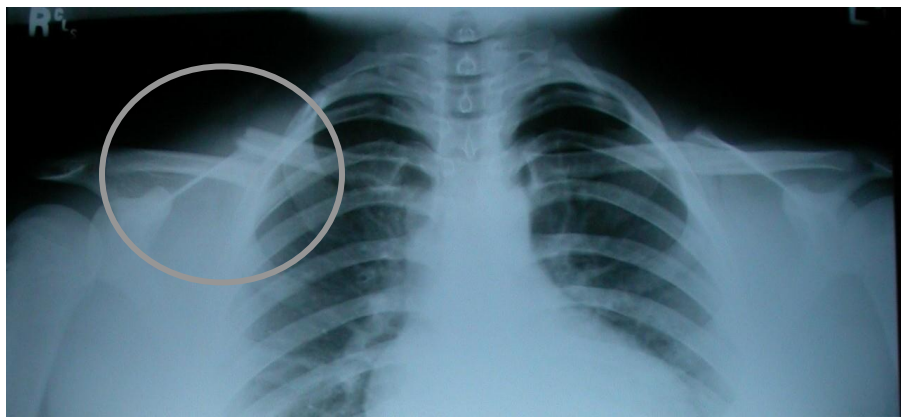
There are several other “connections” including the sternoclavicular joint, the coracoclavicular joint, and the scapulothoracic joint- although they are less commonly injured and won't be discussed further here.

## **Injury:**

### **Clavicle fractures**

Clavicle fractures are extremely common in youth. It is most commonly due to falling on the shoulder and results in a mid-clavicle disruption. Fractures on the outer third of the clavicle are also seen, while fractures on the inner third of the clavicle are less common and more dangerous- since the injury occurs near blood vessels, nerves, and vital organs. Fractures in the inner third of the clavicle require careful evaluation, while fractures in the middle or outer third rarely require more than a figure 8 brace for four to six weeks. In fact, some physicians choose not to treat mid-clavicle fractures at all, believing they almost always heal in childhood regardless of intervention. Most clinicians though, believe the figure 8 brace (or arm sling) offers additional comfort, protection, and possibly a better outcome.

X-rays are always satisfactory and usually obvious. Slight angulations (under 40 degrees) and some fragmentation (more than one piece) is common. A lump over the skin is also common at the site of the fracture, and typically but not always resolves after several months. Tenting of the skin (or true breaking of the skin) due to the fractured clavicle requires more technical evaluation and treatment.



### **Clavicle Fracture Warning Signs**

Orthopedist does not need to be involved unless:

Tenting of the skin, or broken skin

Breathing trouble

Inner third of the clavicle is fractured

More than 40 degrees of angulation or severe displacement

### **Questions to ask your doctor**

1. When is it safe to return to sport- most sports interested doctors will allow you to practice as soon as you are pain free- but no contact, or scrimmage, or throwing for about six weeks.
2. A figure 8 brace is normally enough, unless there is relief with the sling also. If a sling is given- is it necessary? The sling prohibits arm usage.
3. If the inner third is involved- ask whether an orthopedist needs to be involved.

### **Biceps tendonitis**

Often mistaken for a shoulder injury, biceps tendonitis is an overuse injury of the biceps muscle. In adulthood, this tendon can rupture, causing a “popeye” arm. In childhood and adolescence though, the biceps tendon may get irritated but rarely ruptures.

Swimmers with poor technique, young baseball pitchers, gymnasts, and wrestlers are most commonly injured. The pain is at the top of the biceps muscle and below the shoulder joint. Pain is increased with “Speed’s Test” and no x-rays or other diagnostic tests are necessary.

Treatment involves physical therapy and the correction of any poor technique that may have caused the overuse of the tendon. Typically young athletes attempt to use their strongest muscles, even if the skill normally doesn’t involve that muscle. Thus a swimmer may use their biceps, rather than their shoulder and back, during a stroke when they are first learning it or have suddenly increased intensity.

### **Impingement Syndrome, Swimmer’s Shoulder**

Premier and Elite level swimmers as well as male gymnasts and weight lifters often have shoulder pain. This is most likely the reason why.

The shoulder is an enclosed joint. There is little room for increased muscle growth (hypertrophy) or swelling and inflammation after an injury. The rotator cuff area, made up of four muscles (the SITS muscles- supraspinatus, infraspinatus, teres minor, and subscapularis), their tendons, and the surrounding bones and bursa (protective cushion) are in a small area. This area is “opened” up when the shoulders are pulled back, like a military officer- and “smaller” when the shoulders are rolled forward, like an unhappy, “pouting” child. Indeed, when mom tells you to “keep your chin up, have good posture, and stand at attention”- she was right! Posture does make a difference.

Now back to sports- in swimming, wrestling, and men’s gymnastics- the skills are largely involving the muscles in the front of the body and the large muscles of the shoulder. This includes the pectoralis major and minor as well as the deltoid. Freestyle and butterfly stroke in swimming as well as rings and parallel bars in gymnastics concentrates on chest and large muscle shoulder strength. Unless the coach or athlete has a separate workout to balance the relatively weaker back and small shoulder muscles (rotator cuff)- the athlete’s posture will “slouch” forward and shoulder pain will result. The shoulder pain is from tendons and muscles running into each other in the relatively small space created by the shoulder rolling forward. This inflammation will continue until posture is corrected and the small shoulder muscles are strengthened. To reduce shoulder pain- back muscles must balance chest muscles and large shoulder muscles must be balanced by the smaller shoulder muscles.



Pain and inflammation due to “impingement syndrome” type over use.

Adults may have impingement syndrome for years and eventually with poorer blood supply and chronic inflammation- and typically over the age of forty- a rotator cuff tear may occur. This causes chronic pain, nighttime gnawing pain, and decreased range of motion in the shoulder. Surgery is necessary for repair.

Thankfully, children and adolescents almost never tear their rotator cuff (except in extreme trauma)- and impingement syndrome is successfully treated with physical therapy and no need for injections or surgery.

### **Tests for Impingement Syndrome**

Neer’s sign and Hawkin’s sign

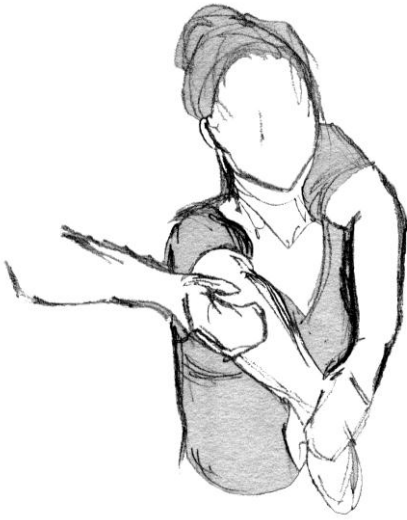
Normal x-ray is common- there may be a large acromion causing impingement

MRI may show inflammation but almost never a tear

### **RULE OF THUMB:**

It is uncommon to have a rotator cuff tear before the age of 40- normally pain at the rotator cuff site below the age of 40 is tendonitis or impingement type pain treated with physical therapy- rather than a tear requiring surgery.





Impingement syndrome testing includes Neer's and Hawkins sign

**Deltoid must be balanced by the rotator cuff muscles:**

Supraspinatus  
Infraspinatus  
Subscapularis  
Teres Minor

**Pectoralis major and minor (chest) must be balanced by the scapular stabilizing muscles:**

Trapezius  
Rhomboids  
Latissimus Dorsi  
Teres Major and Minor

**Questions to ask your doctor**

Can I work out during PT? Normally you can do pain free activity during rehab.

If an injection or surgery is offered and the patient is a child- get a second opinion. While steroid injections are common during adulthood, there are warnings for this treatment in childhood and adolescence.

**Treatment Strategies** see page 7 for info

Physical Therapy-5 the earlier the better, waiting to do PT may result in a torn rotator cuff in adulthood

Relative rest-5

Ice and NSAIDS- 5

In adulthood- steroid injection, 3

Possibility of surgery- 3 to remove acromion for added space

## AC Separation

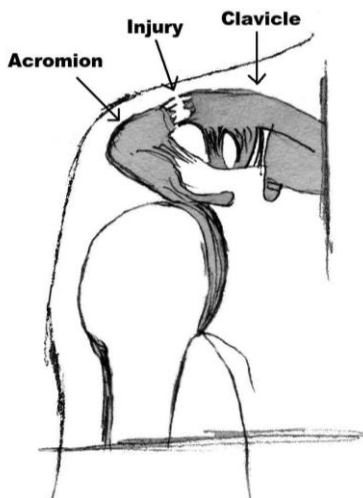
An acromio-clavicular separation is most commonly due to a fall on an outstretched arm. It is classically described in football and soccer. The pain is in the front of the shoulder rather than in the joint. A fractured clavicle is possible with this injury.

There are several types of AC separations with the Grade I least severe and the upper grades more severe. Grades 4 and above may require surgery, while Grades I-III seldom require more than an arm sling, rest, and physical therapy.

Pain is at the acromion and may result in a lump that usually resolves in several weeks to months. There may be a “sag” sign- pulling down on the arm causes pain and laxity compared to the uninjured arm. Neer sign will be painful as well.

Xrays may show slight increase in space between the acromion and clavicle- and the clavicle may be higher than the acromion- especially if the athlete holds a weight during the xray.

Treatment involves a sling for comfort, physical therapy for recovery, and up to several weeks before return to competition. No pain and normal range of motion are the keys for return.



## **Little League Shoulder**

This injury is seen in skeletally immature baseball pitchers and less often in gymnasts and swimmers. It is an epiphysiolysis- an injury at the growth plate of the humeral head. Although an overuse injury is the cause- it should be considered a growth plate injury.

The injury is almost always characterized by the athlete as painful just below the shoulder joint and lateral to the rotator cuff / impingement point. Sometimes the athlete recalls a painful throw that started the pain. And although the patient recalls a specific throw that “started the pain” it is more likely that the injury occurred over a longer period of time and finally the symptoms got bad enough to complain about.

Diagnosis can be made with a good history and physical alone although a plain film x-ray showing a widening (gap) at the physis (growth plate) of the humerus is nice for documentation.



Treatment involves complete restriction of pitching but no immobilization. Most sports interested physicians will have a protocol for returning to sport. While none are exactly the same- most look something like this:

3-6 weeks no throwing, no pitching, no field positions, batting allowed if pain free

Next 3-6 weeks- may play in the field (and throw), batting allowed if pain free

Afterwards- if no pain, may return to limited pitching (no fast balls), if pain free may return to full pitching by 2-4 months including fast balls- no curve balls until after age 14.



**RULE OF THUMB:**

No curve balls pitched until 14-15 years old.

Throwing sports deserve comment. Pitch counts are important to preserve young athletes' elbows and shoulders for their long career. College and professional pitchers may be more numerous if it wasn't for the number of young athletes who lose their career to injury because of over zealous coaches and parents pushing their children when in Little League ball.

Here is an example of an acceptable pitch count estimate per age allowed by the youth baseball association (there is more than one acceptable pitch count program- but little league programs should find one and take it seriously)

8-10 years- 50 pitches

11-12 years- 68 pitches

13-14 years- 76 pitches

15-16 years-91 pitches

17-18 years- 106 pitches

No curves until age 14

There are high school protocols such as the 8/80/2500 rule:

No more than 8 months per year of pitching

No more than 80 pitches per day

No more than 2500 pitches per year

Listening to the athlete is far more important though than the numbers- if the athlete complains of pain- take care of it early... waiting until the end of the season could be asking for an early retirement from the sport all together.

## Dislocation versus subluxation

Athletes may go to their doctor or trainer and say “my shoulder fell out of socket”. Defining what actually happened is important.

A dislocation is when the head of the humerus leaves its normal position and stays out- requiring manual manipulation to put it back into place. Normally this occurs during a forceful blow from the back and the head of the humerus dislocates anterior (forward)

A subluxation is when the head of the humerus leaves its normal position for a brief second or two and then returns to the correct position without manipulation. This may be due to trauma or weak scapular stabilization muscles or a previously injured rotator cuff. This is more common than dislocations in the adolescent age group.

Diagnosis of a dislocation is relatively easy. It is extremely painful, disfiguring, and unless reduced immediately- may require sedation to relax the muscles enough to put it in the correct position. Trained health professionals need to be involved. The “Mel Gibson” (from the movie Lethal Weapon) approach to treatment is not recommended!

Diagnosis of subluxation is more difficult because the health care provider may not have the opportunity to see the event and the subluxation corrects itself before evaluation.

Both scenarios predict future problems. Both cases suggest that future dislocations or subluxations may occur- and if it recurs a second time- it almost certainly will continue.

X-ray and MRI with contrast into the joint (arthrogram) help detect injury to the shoulder joint (the labrum and other surrounding structures). The **labrum** is the cartilage area lying around the glenoid (arm socket) that “pads” the head of the humerus and increases the shoulders ability to have such a great range of motion. It also is the attachment of the biceps tendon to the shoulder. While injury requiring surgery to the one of the rotator cuff tendons is relatively rare in athletes under forty years old, injury to the labrum is possible even at a young age, especially after a dislocation or subluxation. Physical therapy is still an option in many cases, but labral tears (typically best diagnosed with contrast injected into the joint, arthrogram, and seen with MRI) often eventually require surgery. Sometimes a labral injury is even suggested on xray, typically suggesting a more ominous injury and more likely requiring a surgical remedy (Hill Sachs deformity or Bankart lesion).

While the first dislocation or subluxation may be considered “bad luck”, subsequent events suggest the need for an orthopedic surgeon to become involved as it may eventually require special bracing or a surgical remedy.

## **Stinger/Burner**

This injury is actually a nerve injury- but is explained in the shoulder section. Most common in football players and wrestlers, if it is an isolated injury, a stinger is much more scary, on its first occurrence, than it is dangerous- in most cases. If it is recurrent, or combined with an injury also involving a concussion or neck trauma- it is potentially very dangerous.

### **Anatomy:**

The brachial plexus is a bundle of nerves going from the neck, through the axilla (arm pit) in the shoulder, and into the arm. Like an extension cord for taking electrical impulses from the neck to the hand- the brachial plexus is long- but only has so much “play” before it is over-stretched.

There are three situations that can cause the brachial plexus to be injured.

1. Overstretching due to the neck being forced in one direction and the shoulder forced in the opposite direction (a distraction of the nerve)
2. Direct strike to Erb’s point- a “Spock” hit (from Star Trek) can temporarily injure the Brachial Plexus
3. A compression to the brachial plexus causing injury. In this example the neck is turned to the same side as the shoulder with the tingling. This can also occur with axial loading to the head and neck- a strike or force from the top of the head compressing the neck downward. This can result in neck injury as well.

In all three scenarios, the result is a tingling or “lightening” sensation followed by temporary numbness and paralysis of the arm. This is tremendously frightening if it is the athlete’s first occurrence. Thankfully, it almost always resolves in twenty to thirty minutes- but can take several days for complete recovery.

### **Side line management: First stinger**

Rest, ice

Full exam by medical professional\*- neurologic and muscle strength range of motion and testing before return to sport

If painfree and normal physical by trained medical provider, may return same game

\*Certified athletic trainer or physician to safely evaluate before athlete may return

**Recurrent Stinger** (more than 1 per season) **or lasting more than 30 minutes**

No return to game

Evaluation by doctor

Consider x-ray to find possible extra rib, abnormally shaped 1<sup>st</sup> rib or abnormally shaped cervical spine

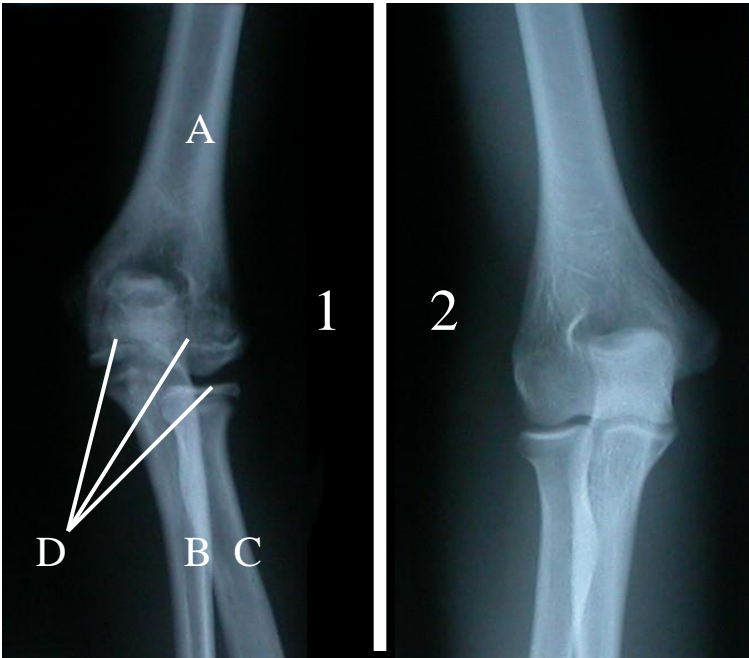
Consider MRI to measure diameter of foramina that brachial plexus and spinal cord travels (is it too narrow), is there spinal stenosis (narrowing)

Some athletes have several stingers per season- and there are athletes that state they have a stinger every game! This athlete requires a workup to ensure he or she is not endangering his adult career in sports and normal life! Repeated stingers suggest the potential of a narrow space for the nerves to travel (foraminal stenosis) or an abnormal shaped or number of ribs or cervical vertebrae. Even though the stinger is temporary- if it is recurrent- it should not be ignored.

# The Elbow

The elbow, in my opinion, is the most difficult joint to deal with. The young athlete has multiple ossification points (growth plates) that can be mistaken for fractures or abnormalities.

First the anatomy involves the humeral ulnar joint at the trochlea, the humeral radial joint at the capitellum both allowing for flexion and extension of the elbow- and the radio-ulnar joint allowing for supination and pronation (twisting the forearm). There are two collateral ligaments (just as there are in the knee)- the medial and lateral collateral ligaments.



1. Elbow x-ray – growth plates open (immature)
2. Elbow x-ray- growth plates closed (adult)

- A- Humerus
- B- Ulna
- C- Radius
- D- Growth plates (physis)

Each side of the elbow (called the lateral and medial epicondyle) also acts as the attachment for tendons where the forearm muscles attach. The medial epicondyle



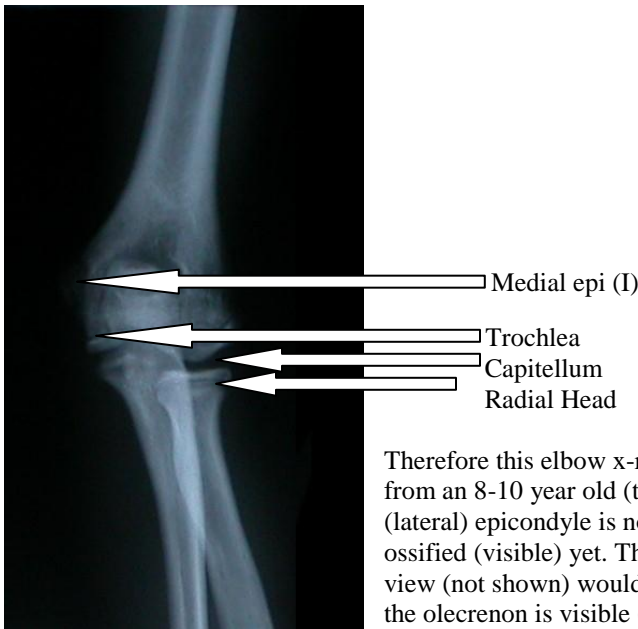
is the insertion for the flexion muscles while the lateral epicondyle is the insertion for the extension muscles of the forearm.

An x-ray of a perfectly normal elbow can be extremely difficult to interpret. And so a radiologist or orthopedic surgeon comfortable with the pediatric elbow can be the difference of making the diagnosis or missing it.

At different ages, the elbow looks very different. Although the joint space may look similar- the surrounding structures are constantly changing.

CRITOE is a mnemonic that illustrates the ossification points added to the elbow at various developmental times. This is a less accurate but easy way to remember when the growth plates of the elbow show up on xray.

- C- capitellum, around 1 years old
- R- radial head around 3 years old
- I- internal (medial) epicondyle around 5 years old
- T- Trochlea around 7 years old
- O- olecranon around 9 years old
- E- external (lateral) epicondyle around 11 years old



After this point, the elbow of the adolescent looks much the same as the adult. It's no wonder before adulthood, elbow x-rays could be interpreted differently by every physician reading them. Other hints such as alignment and a positive “fat

pad sign” behind the humerus may assist in locating a small or less obvious fracture.

If there is pain and/or swelling- x-rays are absolutely necessary and a physician comfortable with the elbow in children is warranted. And regardless of the x-ray- pain at a growth plate should be protected until further evaluation by an orthoped, sports interested physician, or a repeat exam in a week (when healing may be seen easier on x-ray).

**Tennis elbow- lateral epicondylitis, Thrower’s elbow, medial epicondylitis:**

An overuse of the muscles and tendons around the elbow, typically from poor technique, an increase in training, or overtraining, can cause pain at the insertion point of a particular muscle.

Tennis elbow is from irritation of the muscles dealing with forearm extension while thrower’s elbow is from irritation of the muscles dealing with forearm flexion. Poor technique may result in tennis elbow type pain from incorrectly swinging a tennis racket, painting a wall, or moving furniture. Poor technique in throwing a ball, curling a dumb bell or sorting mail may cause irritation of the flexion muscles at the elbow.

A health care provider can typically identify this with palpating the muscle as well as having the athlete use the muscle and find it painful or weaker than the unaffected side.

Treatment involves non-steroidal medication, ice, relative rest, and physical therapy. A strap, similar to the strap used in patellar tendonitis in the knee, can be tried as well. The most important part of treatment is correcting any poor technique that may have caused the irritation. Good communication between the doctor, coach, parent, and athlete is essential to assure the problem does not recur. If treatment is not successful, x-rays (to ensure there is no bony involvement) and referral to a sports doctor or an orthopedic surgeon would be appropriate.

**Treatment Strategies** see page 7 for info

Medication- 3 NSAIDS helpful

Braces/Straps- 3 worth a try

Physical therapy- 3 Good technique in sport important

Rest- 4 helpful

Ice- 5 always after exercise/therapy

Surgery- 0 not necessary

Sometimes medial epicondylitis type pain results in injury to the growth plate rather than to the tendon/muscle attachment. This can separate the epiphysis (growth plate) and, similar to little league shoulder, cause an epiphysiolysis resulting in what is termed **Little League Elbow**. Although classically explained

in young baseball pitchers attempting to throw curve balls before their elbow is mature- the problem can occur in young golfers, gymnasts, and wrestlers for the same reason.

If this is determined to be the cause of the elbow pain- rest is paramount to avoid prolonged pain and the necessity for possible surgery. The best way to avoid Little League Elbow is NO curve ball or breaking type pitches while the athlete's elbow has open growth plates. Patience in this instance is better than pushing the "advanced young athlete"- as injury risks their career. Return to pitching has a similar approach as Little League Shoulder. X-rays are sometimes necessary to satisfy the doctor that the growth plate is involved rather than just the tendon. A growth plate that has separated too far from its intended location may require surgery.

Little League elbow IS NOT the same as Thrower's Elbow... Little League elbow involves the growth plate and is treated similar to a fracture, while Thrower's elbow involves the tendon and muscle and is treated as a sprain/strain injury. Overuse of the flexion muscles causes pain- without laxity to the ulnar collateral ligament or injury to the medial epicondyle (growth plate). A strap (similar to that used with Osgood Schlatter of the knee), ice and relative rest are the treatments for Thrower's elbow.

**Valgus overstretching:**

In athletes where the growth plate is closed (mature), the ulnar collateral ligament may be injured. This is uncommon in the growing adolescent- as the medial epicondyle or flexion tendon complex is typically injured first. The health care provider will feel a laxity- or an opening- when stress is placed on the elbow joint. The ulnar collateral ligament is "too stretchy". Thrower's elbow- while in the same area- has pain with flexing the forearm but no laxity when stressing the joint. Ice, ibuprofen, relative rest and physical therapy to ensure good technique are the treatments. Surgery is rarely required for an ulnar collateral ligament injury in the adolescent age group. Repair of the ulnar collateral ligament, Tommy John surgery, is sometimes necessary in the high school, college, and adult age group.

**Warning Signs of Elbow Pain that warrants further workup**

Trauma rather than gradual onset

Swelling at elbow

Fever

2 weeks of rest, strap, physical therapy and continued pain deserves an exam and possible x-rays

**Osteochondritis Dessicans**

This rather unusual overuse syndrome occurs in older teens at the capitellum (radial side of the elbow). An area of bone becomes avascular (not enough blood

supply) and may even “break off”. Symptoms include swelling, locking of the joint, and pain. X-rays and MRI are helpful in determining the extent of the problem. Rest and occasionally surgery are required. Return to premier level sport is expected but elite, college, and Olympic level return to sport is difficult to guarantee.

### **Panner’s Disease**

Panner’s Disease is an osteochondrosis at the capitellum similar to Sever’s in the heel and Osgood schlatter’s in the knee. It occurs in young adolescents (7-11 years old) and typically resolves on its own with rest. Pain and swelling is the symptom and x-rays are helpful for diagnosis. Occasionally MRI is necessary to determine an OCD lesion from a Panner’s type syndrome. This borderline type scenario may better be answered by an upper extremity orthopedic surgeon comfortable with pediatrics. Some experts have discussed Panner’s osteochondrosis and OCD lesions being a spectrum of the same problem- while other specialists describe them as two distinctly different diagnoses.

### **Tinel Sign- Ulnar Nerve Injury**

An injury to the medial elbow such as hitting the elbow on the corner of a table will cause tingling and numbness in your arm and fifth finger. Everyone has “hit their funny bone” sometime. This injury is due to the ulnar nerve being relatively unprotected. While most people’s tingling goes away in several minutes, it is possible to have prolonged pain and even weakness after an injury. The “Tinel Sign” is when a health care provider taps on the area of the ulnar nerve’s path and the sensation of tingling and numbness returns at the area of the elbow and into the fifth finger. While this proves the diagnosis- sometimes further testing is necessary to tell the extent of the injury. Electromyelograms (EMG) and nerve conduction studies are sometimes used to test the nerve and an MRI is occasionally ordered to show the anatomy of how the nerve traverses through the area of the elbow into the forearm.

Treatment is ice and rest and avoiding a similar strike to that area of the arm. Physical therapy for neural stretching techniques can be helpful. If the anatomy is abnormal, surgery may be necessary to reduce the incidence of neuropathy (nerve pain). Chronic repeated injury to the ulnar nerve can cause irreversible weakness to muscles innervated (needing information) by the ulnar nerve.

### **Fracture**

Elbow fractures normally occur after a traumatic incident although occasionally are found after prolonged elbow pain and swelling and no recalled incident. Any athlete with elbow pain, locking, or swelling should have an x-ray. While some fractures are obvious, others are less pronounced. With so many growth plates, it is understandable for radiologists and health care providers to miss a small fracture or call a normal growth plate a site of injury.

It is absolutely necessary to get a good physical exam first and have the x-rays help explain the site of the patient's pain- rather than have the x-rays first and then attempt to identify where the pain might be by looking at the x-ray!

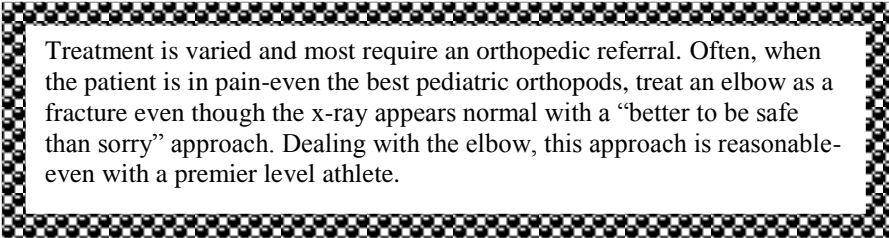
The x-ray is helpful in identifying injury when

A: there is an obvious fracture

B: there is a fat pad sign (fluid at the joint) suggesting injury

C: there is a follow up x-ray one to three weeks later to look for differences in the films- this is key and often the only way to pick up a subtle injury

A supracondylar fracture and radial head fracture are two examples of occasionally overlooked injuries on x-ray that either require a high index of suspicion to treat without obvious x-ray findings or an MRI to prove.



Treatment is varied and most require an orthopedic referral. Often, when the patient is in pain-even the best pediatric orthopods, treat an elbow as a fracture even though the x-ray appears normal with a "better to be safe than sorry" approach. Dealing with the elbow, this approach is reasonable-even with a premier level athlete.

### **Elbow Dislocation**

Elbow Dislocations require medical evaluation in every case. A period of immobilization followed by physical therapy and active bracing is typically the treatment. Concurrent fracture must be ruled out with x-ray.

### **Nurse Maid's elbow**

This is most commonly a young pediatric problem (age 15 months to 4 years), so only briefly mentioned here. When the elbow gets pulled forcefully, the annular ligament around the radial head can become subluxed. Occasionally it will self correct while other times, it is necessary to manipulate it to its correct position. The mechanism of injury along with the typical carrying position of the arm makes it relatively easy to diagnose and typically as easy to correct. A crying, hesitant child coming into the office is normally miraculously using their arm after the manipulation.

Incidentally, x-rays are not required, and if done, often correct the problem during positioning for the picture.

Adults can have annular ligament pain as well. Ice, NSAIDS, and relative rest is the treatment from this overuse injury- rather than having the annular ligament forcefully pulled as occurs in younger children during Nurse Maid's elbow.

## **Olecrenon osteochondrosis:**

Pain at the tip of the elbow (the point of the elbow is called the olecrenon) after overuse and no history of trauma may be an apophysitis similar to Sever's at the Achilles' tendon in the heel and Osgood Schlatter's at the patellar tendon of the knee. X-ray and MRI may not be diagnostic and relative rest, ice, and limited non-steroidal medication and a strap at the triceps tendon may be all that is necessary. A widening at the olecrenon though may indicate an avulsion type injury from the Achilles' pulling on the growth plate. Comparison xrays of the uninjured elbow is often the best way to diagnose this problem. Fractures can also occur at this area. These injuries require time off of sport and follow up before progression back into activity.

# The Wrist and Hand

The hand and wrist are commonly injured in sport. Lacerations (cuts) and fractured fingers are relatively simple to deal with- and are often handled in the emergency department or urgent care. Fractures of the scaphoid bone and injuries to tendons in the hand are more difficult to treat and are reserved for the hand surgeon's care- as even general orthopedic surgeons are reluctant to tackle these problems. This chapter will briefly discuss the more common problems seen in young athletes- it is by no means exhaustive.

**Gamekeeper Thumb-** Gamekeepers were farmers who broke the necks of chickens and the repetitive snapping placed stress on the farmer's ulnar collateral ligament of their thumb. This caused pain and inflammation. Today, soccer goalies, and snow skiers may place similar strain on their thumb.

Diagnosis: normally a good physical exam is all that is necessary, although sometimes an MRI is used to rule out other problems.

Treatment: a brace is available for this specific problem which rests the thumb and wrist. Typically 3-6 weeks will take care of the pain and reduced range of motion.

**The Ganglion Cyst-** This relatively common problem is seen in gymnasts, bowlers, and other athletes that put excessive strain on their wrist and hand. A synovial sac at the tendon filled with a jelly like inside can expand large enough to be detected with simple palpation of the wrist. It is most commonly felt between the radius and ulna just above the hand. While small- it is not painful, however if it enlargens- it can be quite sensitive to touch and wrist movement. Pressure with wrist extension is typically the most painful.

Diagnosis is almost always made in the office without special tests.

Treatment is varied- in Eastern medical literature- a large book was used to smash the synovial sack! This is not standard of care in the United States! Some patients choose to "ignore" the benign nuisance while others have it aspirated with a needle or injected with steroids- with the chance of it refilling and returning to its original size. Finally, some have a general surgeon or orthopedic surgeon remove the sack- with the majority of patients pleased- still some ganglions not completely removed will return even after partial removal. While most common in the wrist, ganglions can be found in other places including the fingers and hand.

A cartilage "boss" is similar although a "bony" growth is attached to the tendon- surgery is the treatment if it bothers the athlete.

**Distal Radius Salter Harris I Growth Plate Injury- "Gymnast Wrist"-** Often overlooked or misdiagnosed as a wrist sprain, this injury occurs in athletes weight bearing on their hands.

**Diagnosis:** Xray can often pick up the subtle changes at the growth plate at the end of the radius, especially when compared to the xray of the wrist that isn't hurting, but physical exam is all that is necessary.

**Treatment:** Splint or cast for several weeks to rest the growth plate. Return to sport in four to eight weeks is the norm.

**Outcome:** Typically the outcome is good with resolution of pain and continued normal growth at the distal radius. Even with acceptable treatment and rest, a minority of athletes will have a growth plate arrest (the radius stops growing as the ulna continues to grow) resulting in ulnar variance positive. This is realized in follow up xrays taken months, or years, after the initial injury. Ulnar variance positive results in an anatomic asymmetry that can cause a stress fracture at a carpal bone (impaction syndrome), a tear of the TFCC, or chronic pain. The treatment is a surgery once the bones are done growing post puberty. Athletes can continue competing after recovery and physical therapy after surgery.

**Jersey finger:** Injury to the flexor digitorum profundus tendon of the finger, Jersey finger most commonly occurs while gripping an opponent's jersey and a twisting mechanism injures the distal joint- of typically the ring finger.

**Diagnosis:** typically with exam alone

**Treatment:** In complete detachment of the tendon- surgery must be performed, normally in the first week after the injury. If only injured without complete detachment, splinting is the treatment.

**Kienbock's Disease:** This avascular necrosis of the lunate bone in the hand is similar to Leg Calve Perthes in the femur.

**Diagnosis:** x-ray

**Treatment:** Rest and occasionally surgery.

**Lunate dislocation-** While uncommon, this injury can be detected by x-ray- two carpal bones (hand bones) appear widened. The problem appears to look like separated buck teeth like David Letterman. Treatment is typically by a hand specialist.

**Mallet finger:** Injury to the extension tendons, the tendon alone, or a fragment of bone at the distal joint of the finger can result after a traumatic event- such as catching a ball.

**Diagnosis** is typically by exam and xray.



**Treatment** includes splinting for 4-6 weeks followed by protection of the joint during return to play for an additional 4 weeks.

**Metacarpal fracture-** Fractures in the hand are common. Falls in soccer and punches in boxing or Tae Kwon Do are examples of causes for injury. A pop along with instant pain may be recalled by the athlete, however some athletes come to the doctor without a recalled injury and only inflammation and pain bring the patient to the doctor.

Occasionally a growth plate is involved. In this case the patient should understand that most of the time- the bone heals well and the growth plate continues to “do its job”. There is the risk though that the growth plate may stop working (arresting or stunting growth) or begin to grow faster at one section than the other (causing angulation of the bone). Both cases are best handled by an orthopedic surgeon- and these problems are the exception of growth plate injuries rather than the rule. Serial x-rays (repeated every 1-3 weeks) are best to follow how progress is going.

**Diagnosis:** X-rays are typically obvious, but stress fractures and growth plate fractures can be more difficult to diagnose and occasionally need a second look.

**Treatment:** Immobilization is almost always the treatment- 3-6 weeks is typically satisfactory.

An example where casting may not be sufficient is a boxer fracture (usually the fourth or fifth metacarpal) may need surgery. Young patients with open growth plates typically “remodel” well and heal with even moderate angulation and without surgery. Rotation of the fracture on the other hand typically requires surgical pinning.

**Phalange fracture-** Unless there is deformity, dislocation, or growth plate involvement- finger fractures can normally be taped to the adjacent finger (buddy taped) or have a splint for 2-3 weeks. Splinting for too long though can jeopardize range of motion.

Diagnosis: X-ray during childhood is still recommended to ensure the growth plate is not involved- especially if it is the thumb or index finger. Checking for rotation is also a reason to get an x-ray, even if it is “just a finger”.

Occasionally a tendon pulls off a piece of bone and the distal joint can not function properly. Surgery is almost always required in these cases. Thus if after a hand injury, you are uncertain if the finger is flexing or extending properly, an x-ray can be helpful.

**Scaphoid (navicular) fracture-** This injury is one of the most difficult to diagnose and as hard to treat. Many orthopedic surgeons consult hand specialists to care for athletes with this problem.

**Diagnosis:** The scaphoid bone is felt in the “snuff box” (at the wrist below the thumb) and is hard to access with x-ray. CT scan is the best way to detect fractures and avascular necrosis (lack of blood supply to the bone).

**Treatment:** If there is no fracture but pain makes a scaphoid injury likely, prolonged immobilization is typically recommended (4-8 weeks). If there is a fracture- immobilization remains the treatment but may not assure healing due to the poor blood supply. Sometimes pinning is necessary, followed by immobilization and finally intensive physical therapy. This injury is often a season ender- and sometimes a career ender as well.

**Subungual hematoma:** Crush injuries to the fingernail can cause blood accumulation underneath the nail. This unsightly and occasionally painful problem can be easily corrected by a health care provider putting a small hole in the nail and releasing the trapped blood. This should never be done if there is a fracture at the finger with the fingernail injury as there is a risk of infection-osteomyelitis.

### **RULE OF THUMB:**

**Fractures in fingers with finger nail injuries (as well as toes with toe nail injuries) should be considered “open” and treatment is best handled by an orthopedic surgeon comfortable with these injuries.**

**TFC tear (triangular fibrocartilage)-** This relatively uncommon diagnosis is often mis-diagnosed as a simple sprain. The pain continues past the typical 10-14 days though- when most sprains are improving or are resolved.

**Diagnosis-** Difficult to access with physical exam, and undetected by x-ray, an MRI is necessary for diagnosis. Pain is typically at the ulnar side of the wrist near the ulnar styloid- the “bump of the wrist on the pinkie side”

**Treatment-** Most commonly this difficult problem is cared for by a hand specialist. Rest is attempted, followed by surgery if there is pain or reduced function.

**Wrist Sprain-** With extreme flexion or extension, the muscles in the wrist may be over stretched, causing pain, inflammation, and decreased range of motion.

Diagnosis is typically with a good exam. X-rays may be done to rule out a fracture- this is not always necessary.

Treatment includes ice, non-steroidal medication, and relative rest. Return to activity may occur as soon as full range of motion and pain below a 3/10 occurs.

Braces may be used in the short term (7-10 days) but should be discouraged for long term use- as normal wrist mechanics are restricted by wraps, “tiger-paws”, and other “therapeutic braces”.

**Things to ask the doctor:**

1. Can I play with a protective brace or cast while my injury heals?
2. If you are referring me to an orthopedic surgeon- do you think he will be referring me to a hand specialist- and should we just get a referral there first?
3. If a growth plate is involved, what is the plan to observe it?

# Medical Issues in Sports



**This text is NOT an authoritative medical resource. It is intended to offer accurate information for parents and coaches to better understand several sports medicine topics and increase their knowledge to better communicate with their health care provider. The information is NOT exhaustive and may change as new information is learned or researched.**

## **The Head- Non-traumatic causes of headache**

Headache may be the number one chronic issue resulting in athletes missing practice, having a bad practice, or excuse for a less than optimal practice. Depending on the reference source, headache has been a problem for almost 100% of people sometime in their life. The reason for a person's headache is various and thus so is the treatment. If the cause isn't known, then the treatment chosen may not be helpful. It is important to correctly diagnose the cause and not assume every headache in every athlete is the same.

### **Common Causes of Headache in the Adolescent Athlete**

Allergies  
Stress/Functional  
Migraine  
Eye Acuity Problems  
Neck Muscular Pain Referred to head  
Nutrition- too little or too much sugar  
Dehydration  
Infections- strep throat, the flu, etc.  
Head injury- concussion

Often with a good history and physical, a primary care provider can offer a good solution to stop the headaches. Rarely, a neurologist needs to get involved because of the complexity or failure to manage the headache with common medications.

In this chapter, the most common chronic causes of non-traumatic reasons for headache will be discussed. For simplicity, they will be listed alphabetically.

Traumatic causes of headache will be discussed later.

### **Less common Causes of Headache in the Adolescent Athlete**

Seizure Disorder  
High Blood Pressure  
Alcohol, drugs

### **Very uncommon causes of headache in the Adolescent Athlete, but not to be missed**

Benign or Malignant Tumor  
Infections- Meningitis

**Allergies:** Allergies are a regional problem. For example a person moving from Florida to the Midwest may notice that he has more headaches due to mold and pollen not found in the southeast.

Allergies are also an environmental problem. Some people may be allergic to things outdoors- such as pollen. Others may be allergic to things indoors such as animals, mold, or dust mites. Still others may be sensitive (but not allergic) to things in the place of their sport such as the chlorine in a pool. Lastly, allergies may be found with foods or in clothing. Allergies may be exhibited with respiratory complaints such as asthma or runny nose, with headache or stomachache, or most seriously, with anaphylaxis- a life threatening systemic (whole body) response to an allergen.

### **The most common allergies and sensitivities**

Food: Peanut, Wheat, Seafood, Milk

Clothing: Nickel (metal)

Environment Indoors: Mold, dust mite, cockroach

Environment Outdoors: Pollen, trees, mold, bee sting

Sensitivities: Cigarette smoke, chlorine in a swimming pool, chalk dust in a gymnasium

Headache is only one symptom of allergy. Briefly, here is synopsis of allergic disease, which is far more complex than can be illustrated in this book.

**The Science-** An **allergen** is something that an individual inhales, ingests, or comes into contact with that their body “over reacts to”. For some reason the person’s immune system believes that the allergen is going to harm them and so in an attempt to protect their body- a cascade of events occurs. These events often are more bothersome and even dangerous than the actual allergen itself.

Here is an example:

Person A can go running through the park without a problem, not even realizing that there is mold growing. Person B, running along side Person A happens to be allergic to mold. The spores are inhaled and Person B produces an increase in histamine, leukotrienes, and various other agents causing a runny nose, itchy eyes, a cough, and in more serious situations- asthma, cardiac collapse, and other symptoms of anaphylaxis. The mold by itself is not that big of a deal- but the body’s reaction and outcome that Person B experiences is a big deal.

Depending on the allergen and the severity of the allergy, the patient may have sinus pressure, headache, itching, stomach ache, breathing problems, or any number of other possibilities.

Even if allergy testing is normal, you may be allergic to something that was not tested. It is impossible for even the best allergist to test for everything- thus when testing results in the patient reads “the patient is not allergic to anything” really

means the patient was not reacting to the 20 or 30 allergens tested. There are thousands of possible allergens that were not tested.

### What to ask your doctor:

1. Is it worth testing to find the allergen, or should we start with a trial of medicine such as an antihistamine, leukotriene inhibitor or intranasal steroid spray?

### Tests for allergy

The gold standard- skin testing

Blood tests- RAST testing, IgE testing, immunocap testing

Immunoglobulin and immune system tests

### Treatment for Allergy

#### The positives

#### The negative

5- Avoidance is best if you know the allergen and can stay away from it

You don't always know what is causing the allergy symptoms

3- Allergy shots work with certain allergens

Takes a while to work, injections, Expensive, doesn't work with every Allergen

4- Antihistamines: Diphenhydramine (Benadryl), cetirizine (Zyrtec), levocetirizine (Xyzal) Fexofenadine (Allegra), loratadine (Claritin) good temporary relief especially if you don't know the allergen

Some are expensive, some are sedating

3- Leukotriene inhibitors- Montelukast (Singulair) works if your problem involves leukotriene cascade- one component of the allergy reaction

Doesn't work for everyone- many do not seem to involve leukotriene.

5- Intranasal steroids- appear to work well for inhaled allergic symptoms

Difficult for children to be compliant with nasal medicines

3- MAST cell stabilizers- cromolyn (Intal) an old safe treatment for asthma and allergy

Takes weeks to work and need to take multiple times per day making compliance difficult

1- Oral steroids- work well if severe symptoms involving breathing problems

Not appropriate treatment for daily allergic problems, with chronic use has more dangerous side effects than with other treatments

## **Dehydration:**

One of the most common, and easily correctable reasons for headache in the adolescent athlete is mild dehydration. Aerobic sports, especially ones played outdoors, are particularly important to watch an athlete's hydration status.

### **RULE OF THUMB:**

The very best way to monitor hydration is urine output. Athletes that urinate a clear to light yellow urine before and after the sports event are most likely properly hydrated.

An athlete that can't urinate after a sports event or has dark colored urine may be dehydrated. Symptoms include a faster than expected heart rate, dry skin, dry mouth, decreased sweating, decreased urine output, headache, confusion, and decreased athletic performance. Medical signs include a faster than expected heart rate, a lowered blood pressure, a decreased capillary refill, and a decreased urine output.

Hydration is another topic that could be discussed in a separate book- but is kept brief here.

### **What to drink:**

First hour of exercise I recommend water- 6-8 ounces every 20-30 minutes.

After the first hour I recommend a drink with electrolytes- Gatorade™ is one example.- 6-8 ounces every 20-30 minutes for outdoor sports and aerobic sports (running, soccer). Anaerobic sports and indoor sports (gymnastics) may require slightly less fluid breaks.

Athletes that drink only water will be fine for most activities lasting an hour or less. Activities lasting over an hour such as a soccer tournament with three games the same afternoon will benefit from an electrolyte drink containing potassium, sugar, and sodium.

Athletes that only drink electrolyte drinks, disregarding water can have less than optimal outcomes. The sugar in some electrolyte drinks can cause abdominal pain, diarrhea, and gas. Some athletes are far more sensitive than others. These are not good symptoms during a competition!



### **Things that hasten dehydration:**

Outdoor sports in the heat

Infrequent opportunities for water (should be every 20-30 minutes)

Alcohol

Caffeine and/or taurine- “Energy drinks”

“Too cool” to take a break for water, coaches and team mates should never discourage frequent breaks for hydration

### **Warning:**

Every year there are examples of professional and amateur athletes that die from problems involving dehydration. The most media attention is on football players- but it can happen in any sport.

**Dehydration is a preventable cause of death in sport-**

and NEVER caused by an accident such as an unlucky hit or fall.

Injury to the kidney (rhabdomyolysis), brain, and heart are just some of the problems with moderate to severe dehydration and heat illness.

Drinking water can not be overlooked. It’s easy and very important.

### **Eye Acuity:**

Vision disturbances are a correctable reason for headache. It is also an often forgotten cause. Squinting, headache after school, and problems with reading are a few hints that the eye doctor may be the answer to the problem.

### **Infection:**

Sinus infections are a common reason for headache. Other common causes include strep throat, mononucleosis (and other viruses). Antibiotics do not cure viral causes for headache!

Less common causes include tick bites (Lyme disease), spider bites (Black widow), mosquito bites (West Nile Virus). Once again, antibiotics are an important tool to combat bacteria- such as lymes, but do not help with viral causes for infection- such as West Nile Virus.

Rare causes include meningitis and encephalitis. These life threatening infections can be caused by a number of bacteria, viruses, or fungus. Treatments vary but typically involve hospitalization often in an intensive care unit setting. Symptoms include, neck pain, fever, chills, and an ill appearance.

**Migraine Headache:** Some sources suggest that up to half of adolescent headache are due to migraine. Regardless of the actual statistics, migraine is under-diagnosed, under treated, and often misunderstood. Migraines can occur in young children. Once officially diagnosed in pre-teen years, parents of migraine sufferers recall that symptoms of migraine may have started occurring when their child was as young as four or five years old, overlooked as “irritable”, cranky, tired, or hungry.

A migraine headache is pain due to the contraction and dilation of blood vessels surrounding the brain. The headache is often severe and may be associated with visual disturbances (scotoma), vomiting, and sensory changes (tingling in the hands for instance). Classically, the headache is one sided, but not always.

Diagnosis is often made by history and physical alone. Some physicians utilize MRI- with and without IV contrast- to rule out other causes of severe headache- but this is not absolutely necessary and is unable to prove the headache is from a migraine. A blood pressure and vision check along with a good physical exam is necessary.

The cause of the migraine (the trigger) should be investigated. Sometimes the trigger is hunger, too much sleep, too little sleep, a certain food, a certain smell, or a particular stress. Females can have a migraine during their menstrual cycle and often migraines are triggered after a stressful time- such as just after final exams, the big meet of the year, or a first date. Sometimes, there is just no rhyme or reason for the onset.

Treatment starts with non-steroidal medications like ibuprofen (Motrin or Advil) or naprosyn (Aleve) but often results in the use of triptans (such as sumatriptan (Imitrex) after age 12), anti-nausea medication, and in some instances seizure medications, which can help even though migraines are not seizures. Chronic, frequent migraines are treated with various medications including cyproheptadine (Periactin- an allergy medication), beta-blockers (Propranolol- hypertension medication), serotonin reuptake inhibitors (such as Zoloft), anti-epileptic medication (such as Gabapentin (Neurontin) or levetiracetam (Keppra)), and tricyclics (such as amitriptyline (Elavil) or nortriptyline (Pamelor)). Each have their positive and negative aspects- careful follow up is necessary, and often the goal becomes reduction rather than complete elimination of the headaches. Narcotics are occasionally needed and should be avoided if possible due to their potentially addictive properties. If at the elite level, the drug should be checked to be sure it is not on the banned list of medications for the athlete. Sometimes a TUE (therapeutic use exemption) form is permitted for use in certain situations.

Migraines can be sudden and sporadic or they can be chronic and debilitating-affecting school, social activities, and sport. A team of doctors are sometimes necessary including a primary physician, a neurologist or migraine expert, and a

psychologist- to help deal with missed activities and how to deal with chronic pain.

Not all headaches are because of stress and some need special medication that can improve the headache and the overall quality of life for the patient. Consider another diagnosis if there is a fever.

### **Stress/tension and functional headache**

As one of the most common causes of pain, tension headaches are a cause of missed school, sports activities and family events. Typically characterized as “band-like” pressure around the head, tension headaches are difficult to explain by young children. Sometimes the only symptom is a child who is slightly more quiet or less energetic than expected. Rather than “hiding” the fact that they have a headache it is quite possible that they simply can’t explain the feeling. Other children may complain daily of headache due to the attention they receive, the dynamics of the family or school setting, or an adjustment disorder due to high anxiety, depression, or poorly handled expectations by the child or parent. Regardless of the reason, the pain is real and can be severely debilitating, affecting grades, athletic performance, self esteem, or relationships with others.

#### **Warning Signs to consider another diagnosis other than stress and tension**

**Neurology referral, or special testing:**

First AM headache from time of awakening, Vomiting with headache, vision disturbance, Weight loss, fever, movement changes

#### **Things that can cause Tension Headache**

- School Performance
- Athletic Performance
- Family Expectations
- Self made goals
- Muscle tension due to exercise, poor vision, yelling/crying, chewing gum, teeth grinding, tic disorders
- Attention deficit disorder, anxiety disorder, depression

The treatment is most often ibuprofen or naprosyn and rest- although the BEST treatment is finding the cause of the tension and avoiding it. Often a school tutor, psychologist, or friendly mentor can relieve anxiety or poorly understood expectations. Adjustment disorder due to a traumatic event, divorce, death in the family, or other event can be difficult to discuss- and result in symptoms such as headache or stomachache.

**Diagnosis and Treatment strategies:** see page 7 for info

Medicine: 3-nonsteroidal anti-inflammatories are best studied

Relaxation/Biofeedback: 5: for those that can learn it, it can be the best remedy

Chiropractic: 3- helpful for many

Behavioral Therapy/Psychology: 5- learning the cause of the tension results in preventing future headaches.

Special testing such as CT scan/MRI/EEG/surgery: 0: almost never necessary, always expensive, and rarely beneficial in finding the diagnosis

Vision and Blood pressure check: 5- inexpensive, easy to do, worth ruling out something that causes headaches that aren't caused by tension

# Traumatic Causes of Headache

## Concussion

The management of concussion has changed more in three years than any other topic in this book. Not only has it become one of the “hot topics” in community sports medicine clinics treating high school and college athletes, it is the “hot topic” in medical research, sport’s product development, national sport’s media, and yes, even professional sport’s litigation.

Hopefully this chapter will make you aware of some new information and break down some myths from past misunderstood information.

### Sports where Concussion is more likely

<b>Football</b>	<b>Cheerleading</b>	Auto Racing
<b>Soccer</b>	(4 times more risky for females than males)	
Bicycle and Skateboard (wear a helmet!)		
Lacrosse	Ice Hockey	Snow Skiing
Wrestling	Basketball	

**First, the definition of concussion is a traumatic brain injury, typically temporary, and often with multiple problems** involving cognitive signs such as memory, reaction time and concentration, physical signs such as balance problems, emotional signs such as irritability, and associated with symptoms such as headache, nausea, and difficulty falling asleep.

**Symptoms of Concussion**- you need only one symptom (not all)- after an impact or whiplash

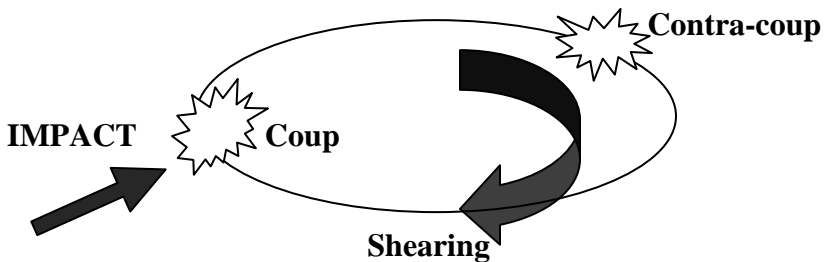
Headache	Nausea/Vomiting
Light sensitivity	Blurred Vision
Sound sensitivity	Ringing in the ears
Dizziness	Balance problems
Memory Loss	Difficulty concentrating
Mental “fogginess”	Don’t feel right
Confusion	Irritable
Loss of Consciousness- in only about 10% of concussion cases	

**Myth #1:** In a concussion, you must be knocked out.

Not true! **Loss of consciousness (getting knocked out) is seen in less than 10% of people diagnosed with concussion.**

Concussions can occur from impact, such as an athlete's head hitting another player, the ground or a goal post. But concussions also occur from whip lash without impact, such as a car accident, a tackle in football, or a "bad landing" in gymnastics.

The injury can occur in the same area as where the impact occurred (coup), the opposite side as the impact (contra-coup), or, if from a rotational force, can be a shearing injury.



The immediate response by the athlete may be very subtle (grabbing his helmet, getting up more slowly than usual) or quite dramatic (stumbling, going to the wrong side lines after a play, seizure, or loss of consciousness). Symptoms may deteriorate in the next several minutes to hours and become more obvious. A seemingly mild concussion at the onset of the "hit" may worsen and be just as serious as a seemingly more obvious concussion from the onset. All concussions should be treated the same- remove the athlete from activity. The athlete should not return to activity, including sports, driving, or school testing, until seen by a health care provider trained in concussion management.

**I believe Myth #2 may be the most important “take home” message!**

**Myth #2:** Players can return to play the same day they have an injury, as long as they don't have a headache.

Not true! Players used to be allowed back to play by the athletic trainer on the field if symptoms of a concussion resolved within 20 minutes.

**Today, the recommendation (and in some states laws mandate) is that athletes with any symptom of a concussion must be removed for at least 24 hours before returning to sport and only after an evaluation by a concussion trained physician.**

Return to play used to be decided on the “grade” of injury. Today, return to play is decided on return to baseline including no symptoms, a normal physical exam and balance, and a return to baseline cognitive testing (if available).

Short term consequences of a concussion (typically resolving in several days to two weeks) include headache, difficulty falling asleep, altered concentration at school, mental “fogginess”, and change in emotions such as irritability and sadness.

Some, not all, patients have long term consequences of post concussive syndrome (lasting over a month or more) including chronic headache, personality and attention changes (such as depression, attention deficit disorder, and even suicidal ideations), balance difficulties (vestibular), and social interaction problems (such as continuing stable relationships, holding a job, or attending school).

**Post Concussive Problems** – some patients have problems one month or more after injury

Mental Fogginess	Attention/ Concentration difficulty
Sleep disturbance	Agitation, Depression
Headaches	Social interaction difficulty
Balance problems	(with family/job/school)

Scientists and doctors realize that concussion is not just a “ding” to the head. It can result in life changing, and rarely life threatening, injury. After the initial impact or whip lash the brain responds with several changes. Intracellular potassium and extracellular sodium shifts, glutamate levels change, and blood flow alters.

In today's medical environment, concussion management teams include athletic trainers, physicians trained in concussion management, physical therapists interested in vestibular (balance) exercises and relieving neck pain causing a headache, psychologists interested in traumatic brain injury (neuropsychology) as well as behavioral changes after concussion (behavioralists), researchers, and neurologists interested in long term consequences of multiple concussions (resulting in Parkinson like problems, seizures, and rarely death from second impact syndrome).

Most every specialist dealing with concussion realizes that it is almost impossible to completely remove the risk of concussion from sport. Concussions will occur regardless of the best equipment, rules, coaching and officiating. Even if football were to no longer exist... then swing sets, cars, and riding a bicycle are normal life activities that still have concussion risk! The goal, in most specialists' minds is to educate coaches, officials, parents, and athletes of what a concussion is so that if one occurs, the athlete is removed from the possibility of a second head injury- which ultimately can be a much more dangerous, even life threatening situation. While a first concussion is still recovering, athletes are four times more at risk for a second concussion, especially within the first ten days after the first injury. That second concussion can be life altering, and at worst, life ending.

### “Worst Case Scenarios”

A second head impact or whiplash before symptoms have resolved from a first concussion can result in **second impact syndrome**- for an unknown reason the brain is “flooded” with blood and with nowhere to go the brain herniates, quickly causing death, often on the field before the athlete can even make it to the hospital.

**Dementia pugilistica**- multiple head injuries over time cause a Parkinson like disease like boxer Muhamed Ali

**CTE- Chronic Traumatic Encephalopathy**- recurrent head injuries, sometimes small enough to be overlooked and not diagnosed as concussion, result in behavior and personality changes

Kids and adolescents seem to be at higher risk than adults because their brain is still maturing. Neurons and synapses between neurons are still learning, and an injury can take longer to heal. Not allowing for brain rest or risking a second injury puts the young athlete at even more risk for complications, delayed improvement, and potential catastrophic injury. Females also seem to be at higher risk compared to males playing a similar sport.



Diagnosis remains a good history (what happened) and physical (how is the patient acting). Laboratory tests, xrays, CTs and MRIs are not diagnostic, and while research is working on each of these tests to aid in the diagnosis of concussion, the clinician is still ultimately making decisions “on his own”.

**Myth #3:** A CT scan is necessary after a concussion.

Not true! **CT scans** are expensive, subject the patient to radiation, and are only helpful in detecting blood (or mass) after a head trauma- but **can not diagnose a concussion**. If there is a history of loss of consciousness or a patient that is deteriorating in status (continuous vomiting, change in mental status, or seizure) then a CT may be warranted.

Functional MRI, laboratory tests, and computer tests are being looked at- but most of them are in the research phase- not ready for clinical use in the “real world”.

Tests such as SCAT II, SCAT III, and ImPACT™ computer test, and other screening exams may aid the medical provider in decision making of when to return to sport. Ultimately though, until the athlete is symptom free, or back to baseline, the best recommendation is to avoid a second impact or whip lash injury.

### ImPACT™

A computer test that assists the medical provider in monitoring the progress of an athlete’s memory, reaction time, and decision making. A baseline test done before the season starts is the best way to compare to the test done after a head injury to see when a concussed patient is “getting back” to their pre-concussion status. Along with balance testing, the physical exam, and other tools, the ImPACT™ test can help “see” how the athlete is doing rather than depending on symptoms alone. Still symptoms remain the MOST important part of the exam. If the patient has symptoms, he or she is not ready for return to play!

Once a concussion is diagnosed, the treatment is straight-forward. Brain rest along with sports rest are essential until symptoms have resolved. In some patients this takes several days and in others it may take weeks... or months. Athletes should be protected from a second impact along with an explanation to teachers, the school nurse, and counselors that testing and homework should be avoided until the patient is back to base-line. Pushing the patient back too quickly in school only results in delaying improvement of symptoms and risks “bad grades” from headaches, attention difficulty, and mental “fogginess” that likely is not an example of the patient’s normal behavior or scholastic potential.

**Myth #4: Removal from sport is the only accommodation necessary.**

**Not true! Accommodations may need to be made in school, work, social events, and of course, sports.**

Remove from sport- no chance for a second injury

Remove from work

Consider accommodations at school – no testing, limited homework, decrease distractions

Reduce computer, phone, texting, video game time

Brain Rest- low light, low sound, low stress, increase stimulus slowly and based on no return of symptoms

Remove from driving.

Sometimes medications are necessary. NSAIDS such as ibuprofen or naproxen may cause rebound headaches. Once the dose is “worn off” the headache and symptoms of concussion may return worse than before. Tylenol may also have this problem, but to a lesser degree. Post concussive headaches, typically lasting more than a month from the original impact, may benefit from a medication.

**Medications that may help reduce prolonged headaches**

**No one medication is perfect or necessary, talk to a physician before considering, the medicine that helps patient A may not help patient B with similar symptoms**

Anti-hypertensive medicine can help- Propranolol or Inderal

Anti-seizure medicine can help- Topamax

Anti-depressive medicine can help- Prozac/Zoloft, Amitriptyline

Migraine medicine can help- Sumatriptan, Periactin, Pseudofed, Caffeine

Consider NOT using NSAIDS (ibuprofen or naproxen)- caution of rebound headaches. Narcotics almost never to be considered for use during concussion.

Once a patient is deemed “safe to return to sport”, a staged return is recommended. Athletic trainers, parents, and coaches should be involved in the athlete’s return. Any increase in symptoms require a conversation with the concussion management team and a pause in the return to activity.

**5 Step Return to Play** (this is one example and not to be used in every athlete's case, discuss with your concussion management team)

Don't start 5 step return to play until:

- No symptoms of concussion
- Back to baseline ImPACT test if available
- Back to baseline balance, physical exam
- Back to baseline personality, sleep, concentration

\*5 step return to sport with no increase in symptoms before moving to next step

- |         |   |
|---------|---|
| Step 1- | 10 minutes of aerobic exercise  |
| Step 2- | 30 minutes of aerobic exercise  |
| Step 3- | 60 minutes of aerobic exercise and<br>resistance training such as lifting weights |
| Step 4- | Practice in sport planning to play  |
| Step 5- | Full contact/ Ready for game  |

\*Best if done with athletic trainer, physical therapist, or doctor

\* Some concussion experts retest ImPACT after exertion and before return to competition

So why is concussion such a big deal? The NFL is now caught “between a rock and a hard place”. If you are an owner of an NFL team, on the one hand, you hate to give up the money and the fan base by admitting football may be “too dangerous”. On the other hand, how can you ignore the lawsuits from retired players, the research suggesting previous concussions may result in difficulty holding a job, the potential negative change in personality and memory difficulty, and even suicidal tendencies. Along with stricter enforcement of rules, discouraging unnecessary head to head contact, and even NFL paid medical observers to look for athletes on the field with subtle signs of concussion, this professional sport is being forced to take concussion very seriously. The result is that Pop Warner League, high school football, and club level football must also make changes to protect their athletes.

It may not be that there are more concussions than ten years ago. It may be that the media has made parents and coaches more aware of what to look for and subtle concussions are now being recognized. The “tough guy” will say, “Now that I know what a concussion is, I had a bunch when I was a kid, and I’m ok. The only one I was diagnosed with though was when I was knocked out. The others, I just kept playing.” The truth is, he is very lucky... or possibly he isn’t quite as lucky as he thinks. Personality changes, difficulty with colleagues, spouses, children, and friends, memory loss, and even depression and anxiety may not be “the stress of today”... it may be from “the impacts of his youth, high school, and college sport’s career!”

**Myth #5:** Concussions come and go... I had five or six... and I'm fine!

Not true! Some scientists are now recommending expulsion (complete removal) from all contact sport (including basketball, soccer, gymnastics, football, lacrosse, wrestling, volleyball) after a number of concussions, even if the concussions occurred years apart. Some are stating removal should be for one year, while others are suggesting a life long expulsion!

Research for better equipment on the field, better diagnostic tests in the hospital, and better treatment options after diagnosis are being requested by the national sports organizations like the NFL, government agencies like the CDC (Center for Disease Control), and medical organizations like the University of Pittsburg Concussion Center.

Companies interested in reducing injury (as well as making money!) are advertising better helmets, new computer chips in mouth guards and helmets to help detect concussion, as well as sideline computer tests of memory and balance to aid athletic trainers and doctors on severity of injury. And one day, using these products as the "Model T's" of concussion tools, maybe something will significantly help in reducing the frequency or severity of concussions. Today though, most products are gimmicks or, at best, at the beginning stages, without scientific merit. One helmet may be 3-4% better than another, but none are "concussion resistant!" It is fine that the research and product development continues though- as evolution of science requires some experimentation. I am just not recommending the experimentation be done with your athlete or child! So don't be "sold" on a magic cure, an unbelievable new helmet or mouth guard, or a computer test that proves the concussion is gone. It just doesn't exist... yet.

My feeling is continued education so parents and coaches don't miss a concussion, better rules to decrease helmet to helmet impact, and better research on treatment of concussion will be far more important than any piece of equipment or side line computer program. Helmets, mouth guards, and soccer head bands are like seatbelts in a car- they are obvious tools for increased safety- but most crashes in cars are avoided (not by the seat belt!) but because of the intelligence of the driver (not texting, obeying the speed limit, not drinking and driving, etc.) This same concept needs to be remembered in football, lacrosse, cheerleading, and soccer.

Number 1: Rules that decrease the risk of head to head impact, education of the importance of removing suspected athletes that are injured, and proper treatment before returning a concussed athlete to school or sport is paramount.

Number 2: The helmet and mouth guard are important tools of the game.

**Myth #6:** Equipment can prevent concussion

Not true! **New helmets, mouth guards, computer chips inside helmets and soccer head bands promoted by companies to reduce concussion or detect injury do not prevent concussion!** More accurately, they may help (but just a little!)

Helmets that are “better” at reducing concussion may only be 3-4% better than last year’s model of helmet, and none reduce shearing injury from rotation or whip lash injury. And there has not been enough research to tell if soccer head bands are helpful in reducing concussion.

Research still needs to be done before spending money to protect your athlete from a concussion or trusting equipment with a computer chip in making the decision on when to pull your athlete off the field. Athletic trainers and doctors are still better at diagnosing your athlete with a concussion.

**What can be done to reduce concussions?**

1. Rules to reduce head to head contact.
2. Good coaching and officiating.
3. Education to parents, athletes, coaches and officials on what concussion is, recognition is key!
4. Continue research on protective equipment, diagnostic tools, and treatment.
5. Importance of properly fitting mouth guards, helmets, and equipment.
6. Neck strengthening exercises to reduce whip lash injury.
7. Proper training of safe ways to head the soccer ball and tackle in football.

## Example of a Concussion Protocol

Name of athlete: *Jimmy Smith*  
 Date: *8/7/12* Time of Impact: *4:30pm*

Circle boxes accomplished with times. Cross out boxes that were considered but not pertinent.

*Tackled to ground,  
Hit his head, 4:30*

Time: 0-10 minutes

*4:31*

Red Flags- Unconscious, vomiting, "acting strange", seizure

Yes **CALL 911**  
Check airway, neck precautions

Time: 1-20 minutes

*4:33*

Any symptoms of concussion?  
Headache, dizziness, mental slowness, blurred vision, difficulty remembering, nausea, balance trouble

Yes **REMOVE FROM GAME** *4:33*  
do not allow to drive home, no further exercise until seen by doctor  
reported to guardian *David Smith* (dad), 4:40  
to take to ER if worsening symptoms

Time: 5-60 minutes

Return to play if no symptoms after 5-10 minutes of observation, continue to observe if returned to play

GUARDIAN TO CONTINUE TO MONITOR

*Dad picked up at 5:05*

Time: 1/2 - 8 hours

Check athlete again in 30 minutes, then 1 hour later, then 2 hours later, then 4 hours later, then 8 hours later

Red flags and/or New or increased headache, vomiting, change in behavior or decreased level of consciousness

Yes **Take to ER**

Time 24-48 hours

Continue to monitor, needs to see doctor in next 24-48 hours for return to play recommendations

Created by Goldstein, 2012

## Head Trauma- not concussion

These injuries can occur with a football tackle, a bicycle injury while not wearing a helmet, a soccer goal post collision, or a gymnastics injury. Bleeding and/or brain edema occurs most commonly with direct impact. Typically a concussion occurs as well, but rather than the expected recovery, the patient has vital sign changes, breathing difficulty, seizure, or death.

Subdural hematoma, epidural hematoma, and acute cerebral edema are three possibilities- each of which cause mental status change, vital sign changes, and the need for intensive care hospitalization. These injuries are typically obvious and the need for emergency medical attention should not be delayed.

Concussion and head injury is a serious topic. Protocols are changing as quickly as the research suggests, but a protocol should be chosen by the team doctor or athletic trainer to offer consistency on how head injuries will be handled on the field. Coaches, parents, and athletes don't want the star player to be removed from the game- but no one wants a devastating head injury either.

## Asthma:

Asthma is a complex respiratory disease classically thought of in a person “who wheezes”. Often under diagnosed and sometimes trivialized by parents and coaches, this potentially deadly problem deserves a lot of respect.

Next to a de-conditioned athlete (out of shape), asthma is the most likely reason an exercising child has a cough, chest pain or shortness of breath. Although the heart is often the parent’s first concern... thankfully, the heart is rarely the culprit. Still, asthma is a dangerous problem that requires a medical provider for diagnosis and continued follow up for adjusting medication.

### The science:

**Asthma is an obstructive lung problem.** Simply put, the airways are obstructed from getting air out (exhaling). This may cause respiratory distress in the worst cases, a wheeze, cough, or in the beginning merely a “long expiratory phase” (it takes longer to exhale than expected).

**There are many “triggers” that may cause this obstruction:**

- **allergies** (80% of asthmatics also have allergic disease of some kind)- cockroaches and dust mites, certain foods like peanuts, and environmental allergies like mold, pollen, and animal hair are examples
- **the environment**- cold air, dry air, cigarette smoke, chlorine in a swimming pool are not allergies but environmental triggers
- **exercise**- some people that exercise exacerbate their asthma (a 10% decrease in their lung function while exercising determines if they are EIA (exercise induced asthmatics) or EIB (exercise induced bronchoconstriction)) while non-asthmatics lung function stays the same or even improves with exercise.
- **Respiratory illness**- young children are the most common sufferers of RAD (reactive airway disease) where a virus such as RSV (respiratory syncytial virus) causes the child to have symptoms similar to asthma (bronchiolitis), adolescents may get mycoplasma (used to be called “walking pneumonia” that can cause a first time wheeze) that is not actually asthma (a life long problem) but instead reactive airway disease (a temporary asthma like illness that eventually goes away)
- **genetics**- although not fully understood, family history of asthma is a risk factor

Put in the simplest terms- air is breathed in allowing the lungs to oxygenate blood for the rest of the body. Carbon dioxide is breathed out, allowing the next breath to occur. In asthma, the exhalation process is compromised, thus making the next breath in more difficult. Eventually air is “trapped” in the lung and the diaphragm is temporarily lowered to “make more space” for the over expanded lungs. Not only is there **over-expansion**, but **inflammation** of the airways as well. In chronic

asthma (and chronic obstructive lung disease (COPD) most common with years of smoking), there are permanent changes of lung tissue, diaphragm position and body habitus- barrel chest, flattened diaphragm. Treatment while young is important to decrease the risk of permanent changes when an adult.

**The Patient symptoms:** **The most important early symptom is night time cough.** Indeed wheeze is the most obvious- but if the night time cough can be realized as an asthma-like symptom early enough- the patient does not have to suffer with exercise intolerance, wheeze, or a potentially dangerous crisis- “status asthmaticus”.

**The rule of “2’s” is easy to understand:**

Ask your health provider about asthma like disease if your child-

- **coughs more than two nights of every MONTH** and does not have a fever or illness to explain the cough
- coughs with exercise including play ground activity or running in the back yard more than two days of any week
- **coughs during the day more than two days of a week not associated with illness**

Obvious symptoms include wheeze (musical sound on breathing out) and cough, breathlessness with running.

**Diagnosis:**

Asthma is under diagnosed and under treated. It is more common in urban populations- especially in poverty stricken areas. This is thought to be due to early and frequent exposure to allergens such as cockroaches, smog, and dust mites. The population with the smallest numbers of allergy and asthma is the farming community- who have had early and frequent exposure to natural allergens such as mold and animals. This early allergen exposure is thought to “prime” the immune system at an early age, and is called the “hygiene theory.”

The best diagnosis is a good history and physical. The gold standard test can be done in a specialty office or the hospital. It is called a methcholamine challenge.

The best office diagnostic test is the spirometry- a breathing test into a machine that calculates:

FVC- forced vital capacity- ideally how much volume you breathe out in 4-6 seconds

FEV1- forced expiratory volume in one second- the amount of air you can forcibly breathe out in the first second

FEF25/75- a calculation of your small airways

A home test that is not quite as good as spirometry but far cheaper and still worthwhile is a “peak flow”. This cylindrical device measures the amount of air forced out in one second- an approximate FEV1. The number is charted according to the patient’s age and height and compared to “normal”. A 20% below expected



### What else could it be?

**Viral Upper Respiratory Infection or a mycoplasma infection-** typically in adolescence, can cause a “first time wheeze”, treatment is antibiotics if mycoplasma and sometimes a short course of asthma meds

**Vocal Cord Dysfunction:** Often mistaken for asthma, the vocal cords have a paradoxical reaction, closing when they should be open during breathing especially during stress and aerobic exercise such as running. An inspiratory “squeak” or stridor occurs causing obstruction and difficulty breathing (different than asthma which normally occurs in expiration). It is more common in females, and can occur in patients that also have asthma (up to 50% of those with VCD also have asthma). Diagnosis includes pulmonary function tests and visualization of the vocal cords by a scope at an Ear Nose and Throat doctor’s office. Treatment is behavioral and speech therapy or voice lessons to learn proper breathing techniques.

**Gastrointestinal Reflux Disease** can have a cough 30-60 minutes after meal, or with exercise, diagnosis is often history and physical only -although there are tests that can be done, avoid food triggers and consider anti-reflux medication, if patient has asthma- reflux can worsen asthma symptoms

### **Foreign Body, Cardiac abnormality**

result is an excellent clue that there is obstructive lung disease of some kind. A normal peak flow, especially after exercise, is a good clue that the patient is either well controlled with medication or not experiencing asthma at that time.

**Treatment:** The most valuable treatment is to avoid specific triggers that exacerbate the person’s asthma. This is different for every patient and can take years to figure out. Skin testing is an important allergy piece for future avoidance. Preventative medication before exercise is important for those that are affected by it. A plan during illness is important for patients, especially young children, who have asthma symptoms (reactive airway) during respiratory viruses.

**Medications:** Albuterol (Proventil), pitbuterol (Maxair), and racemic albuterol (xopenex) are all “rescue inhalers” that quickly and effectively dilate the bronchioles (the medium airways in the lungs). All come in inhalers that are best used with a spacer (a collection device for the medication until the patient inhales). Newer CFC (chloro-flouro carbon free, HFA inhalers may not need a spacer and are more environmentally friendly. These bronchodilators can be used during diagnosis as a 10-12% increase in FEV1 suggest reversible obstruction.

Most directions explain to use the medication every four to six hours as needed for wheeze or asthma-like cough. In an emergency though- medical personnel will use the drug more frequently. If the medication is needed more than three times in a day, or once a day in two days of a week- a doctor should be notified.

**Frequent bronchodilator use (albuterol) is a sign of poorly controlled asthma. The best controlled asthmatics don't need their rescue inhalers at all.**

**Common long acting bronchodilators**

Salmeterol (Serevent)  
Fluticasone with serevent-(Advair)  
Formoterol (Foradil)  
Budesonide with formoterol- (Symbicort)

**ANTI-DOPING AGENCY: Although not allowed at the international level (IOC banned medication), recreation and premier level athletes can pre-treat themselves to avoid symptoms before and during activity.**

**Common rescue inhalers**

Albuterol- Proventil, Pro-air  
Pitbuterol- Maxair  
Racemic albuterol- Xopenex

**RULE OF THUMB:**

- 1. A night time cough is a sign of poorly controlled asthma.**
- 2. Frequent use of rescue inhaler, bronchodilator treatment is a sign of poorly controlled asthma.**

There is one time when using the rescue inhaler when there is no coughing or wheezing is appropriate.

**Athletes that have a 10% decrease in lung function (spirometry or peak flow tested) or have symptoms with exercise such as cough or wheeze will benefit from pre-exercise albuterol or racemic albuterol to help prevent symptoms.**

In 2007, montelukast (Singulair), a leukotriene inhibitor was FDA approved for prevention of exercise induced asthma if taken two hours before exercise. Albuterol remains an important medication to have on the field- in case cough or wheezing starts.

If albuterol is used more than twice per week (don't count pre-exercise albuterol use) or three times in one day- your doctor may recommend a daily or control medication for your asthma. The National Institute of Health (NIH) has collaborated with pulmonologists and allergists to devise a step-wise approach to treating asthma. Recommendations are to begin an inhaled corticosteroid if there are frequent symptoms or frequent rescue inhaler (bronchodilator) use. Studies suggest that the inhaled route of steroids do not have the same side effects that

have “scared” people with the oral route. One such warning is growth problems (still being researched). It is believed if a proper dose, inhaled corticosteroids (ICS) will not alter final adult height predictions (some studies suggest approximately one inch decrease in height with chronic inhaled steroid use, other studies suggest no height decrease). Weight gain, decreased bone density, adrenal gland suppression, and immune system changes are also studied. The most common side effect (which is still fairly rare) is a local yeast infection in the mouth if the medication is not properly inhaled. It is recommended to brush your teeth after inhalation. Patients starting an inhaled steroid may find that their rescue inhaler use is dramatically less in one to two weeks.

**Common inhaled steroids**  
Budesonide- Pulmicort  
Fluticasone- Flovent  
Beclomethasone- Qvar  
Mometasone - Asmanex

**ANTI-DOPING AGENCY: Inhaled corticosteroids may need a TUE (Therapeutic use exemption form) during sports before use in competition at the international level)**

Patients that don’t have relief may require further medication such as a long acting bronchodilator with their inhaled corticosteroid. This should be reserved for the more complicated patient- as new warnings have suggested that long acting beta agonists may have the risk of tachyphylaxis. This is the down regulation of receptors to a medication that when needed, is not recognized by the body. To better understand this potential side effect, here is an example.

Tom has been on a long acting bronchodilator for three years. When started, his asthma symptoms were out of control, and the inhaled steroid with the long acting beta agonist was a “life saver”. He was able to return to soccer without coughing and he stopped missing school due to asthma complaints. Due to not following up with his doctor but continuing to get refills, he remained on this medication for the next three years and then one day had an asthma attack while playing soccer at a new field filled with pollens. He took two puffs of his albuterol rescue inhaler. It seemed to help a bit. When he returned home he continued to wheeze and took two more puffs of albuterol without any relief at all. He went to the emergency room and was hospitalized for a severe asthma exacerbation. The doctors noted that the albuterol was not helping and Tom required several medications, oxygen, and a lengthy hospital stay.

In this case, the albuterol was not “recognized” as a helpful medication to the obstructed airway because it is thought that the body became “familiar with it” in the long acting form over the last several years. During the emergency, the fast acting form was less than helpful requiring more aggressive treatment. *The FDA*

*states that African American patients using long acting beta agonists for a prolonged length of time are at increased risk for death due to their fast acting beta agonist not working when needed.* It is unclear why one race is affected over another, although scientists are learning that a particular amino acid on the B2 adrenoceptor gene may be involved. The homozygous Arg16 (rather than the Arg16Gly) is found in 25% of African Americans (and 1/6 of all the general American population) and may be the “culprit” for this tachyphylaxis phenomenon. A second risk is using the long acting beta-agonist (LABA) alone, rather than with an ICS (inhaled corticosteroid).

The hospitalized patient, the patient not responding to the rescue inhaler, and the patient in distress may require oral or intravenous steroids. Although more side effects, oral and IV steroids are life saving and should not be feared when used appropriately and infrequently.

Other medications include leukotriene inhibitors such as Monteculast (singulair). This medication helps block a “branch on the allergy tree” and can be a beneficial addition in asthma treatment. Antihistamines and nasal steroids are not directly involved in the treatment of asthma but may indirectly help by treating allergies (found in 80% of asthmatics). Antihistamines should be regulated by a physician in asthmatic patients- even though these medications are over the counter (Benadryl, Claritin, Zyrtec, Allegra)- some asthmatics are exacerbated by antihistamines.

Cromolyn (Intal), ipratropium (Atrovent), theophylline (uncommonly used with so many newer medicines), histamine blockers (diphenhydramine (Benadryl), cetirizine (Zyrtec), Loratadine (Claritin), Fexofenadine- (Allegra), levo-ceterizine (Xyzal), and allergy shots are also used in some asthmatics for better control.

The best treatment includes frequent check ups with your doctor, scheduled spirometry checks for recording FEV1, and careful evaluation of symptoms during the year.

### **Warning Signs**

- More use of albuterol than usual- albuterol in a controlled patient should be rare!
- Night time cough
- Cough during exercise
- Not as much stamina as other kids on the team

Every patient should have an “Asthma Plan” specifically made for them. Here is an example- and should not be assumed appropriate for your asthmatic patient!

## **Example of Asthma Guidelines for a Typical Patient**

**Green:** Peak flow normal, no symptoms of cough or wheeze or exercise intolerance, Orders: take your bed-time inhaled corticosteroid.  
Let's say your Normal peak flow is 300 for instance. (based on patient's age and height)

**Yellow:** Up to a 20% decrease of peak flow, night time cough, exercise not as easy, Orders: take bed-time inhaled corticosteroid and ADD a dose of inhaled steroid in the morning and may consider a long acting bronchodilator, ADD albuterol before exercise and up to four times a day if needed. Peak flow is 275 for instance.

**Red:** More than 20% decrease of peak flow, constant symptoms of cough or wheeze, albuterol not helping, more than three doses of albuterol used today.  
Orders: Call doctor, go to ER, start oral steroids if available.  
Peak flow is 210 for instance.

\* This is an example and should not be presumed to be your asthma protocol. Check with your health care provider for an appropriate strategy.

It should not be presumed that the medication list used last year will automatically be best this year.

Most doctors give information on when to add medication, call the doctor, or go to the hospital. **The most popular system is probably the “Green, Yellow, Red” system.**

**Remember: Frequent bronchodilator use (Albuterol) is a sign of poorly controlled asthma! If you are refilling your albuterol, ask your doctor if you are well controlled!**

**It is also advised that asthmatics receive an Influenza Immunization each Fall season.**

### **What to ask your doctor:**

- Do I need a spirometry checked
- Would allergy testing help
- Is albuterol enough? Do I need a “controller” medication
- Is Advair/Serevent/or Foradil/Symbicort still needed and when should I return to check and see if I still require it
- What about Montelukast (Singulair)

## Attention Deficit Disorder

There is a constant controversy dealing with medications to treat attention deficit disorder and attention deficit hyperactivity disorder- ADD and ADHD.

Here is my approach. ADD and ADHD are real disorders- not “made up by teachers” or “used as an excuse to drug kids”.

It is true though, that some normal kids not needing medication get it, and truly ADD kids suffering and failing in school do not get diagnosed and miss treatment. To avoid misdiagnosis, over diagnosis, and missed cases- the **Conner test and BASQ test** (two examples of many tests) can be taken by the parent and teacher to assist the doctor in realizing if medication would be helpful. I do not believe a parent or teacher “requesting” medication for ADD in their child is enough for a doctor to determine the diagnosis. This leads to misdiagnosing other learning problems, over-diagnosing normal children, and over-prescribing medication.

When it is determined that ADD or ADHD does exist, medication can be quite helpful. The American Academy of Pediatrics recommends first line treatment to be behavioral psychology by itself or with stimulant medication. Stimulant medication comes in sprinkle form for young children, tablets and capsules for children who can swallow pills, and transdermal (placed on the skin). Other medicines such as amotexime (Strattera), seizure/behavior medications like Carbamazepine (Tegretol) and Divalproex (Depakote), antihypertensives like Clonidine (Catapres and Intuniv), and anti-psychotics like Risperidone (Risperdal) should be reserved as second line treatment and more difficult situations- prescribed by psychiatrists and physicians with a special interest in Attention Deficit Disorder.

Stimulants such as methylphenidates (example of some brand names : Concerta, Ritalin, Focalin, Daytrana), methamphetamines and lisdexamfetamine (examples of some brand names: Adderall, Vyvanse), and others do have potential side effects. They are monitored by the Drug Enforcement Agency (DEA) and have been considered dangerous for children with heart conditions.

By altering the dopamine receptor in the brain, stimulants do assist the ADD patient in focusing, much like coffee may help you concentrate longer.

**ANTI-DOPING AGENCY- All stimulants are IOC banned at the international level and on the US Anti-doping Agency banned list of drugs. Some sports allow a TUE (Therapeutic Use Exemption form) for practice (but typically not during competition).**

ADD and ADHD are probably genetic (and possibly from other situations such as a concussion, poor nutrition, and likely other causes) and adults do not “magically” grow out of the problem. Instead, adults who are allowed to choose their career- don’t choose one that involves sitting down in a desk and listening to a teacher! School age patients have an unfortunate situation of having to sit still and concentrate when their mind is moving from thing to thing. As an adult who is a creative painter, construction worker, singer, or athlete, the ADD/ADHD is less likely to be a daily hindrance. This is also why most patients do not need their medication during weekends, holidays, and summer breaks. Their ADD is not gone- but their activity does not require constant demanding attention.

Like most chronic conditions, regular follow up with a health care provider is warranted. Not only can dosages and side effects change, but occasionally complete cessation of the medication can occur if the child learns how to manage the disorder with behavioral techniques. Blood pressure, weight, and diet needs monitoring- typically every three to six months. And occasionally medication needs to be stopped if there is a tic disorder that is worsened with the medication, or a large decrease in weight, or a mood alteration. Every ADD medication should be closely monitored by parents and health care providers for the rare but reported adverse effect of suicidal ideation.

**Warning signs of ADD medication (stimulants), consider changing or stopping medication**

Fast Heart Beat or “Skipped heart beats”

Loss of Weight

Increased Blood Pressure

Change in mood, personality, or suicidal ideation

New onset or increase in tics

Headache that does not resolve after the first week of medication

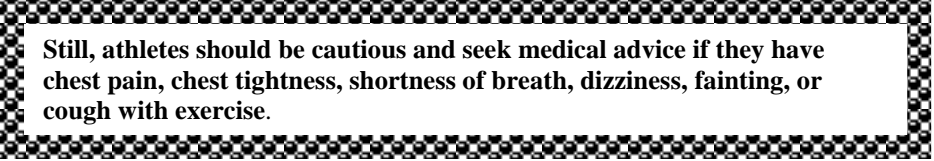
Some alternative treatments such as elimination diets, vitamins, acupuncture, chiropractic manipulation, and “brain games” have been touted as effective. Research continues to try and prove if some of these techniques may indeed help. For the desperate parent, or suffering patient, any testimonial that something will work seems worth a try. Occasionally an alternative therapy is very helpful for one patient but may do nothing for another patient. While it may be safe to try alternative approaches, stimulants remain the treatment that appears to work for the majority of ADD diagnosed patients. Jumping from one alternative treatment to the next, “praying” for one to work and attempting to avoid stimulant medication can result in prolonging social, academic, financial, and family struggles.

# The Heart

Although rare, sudden cardiac death remains one of the scariest disasters to strike an athlete. It remains one of the media's most publicized reasons for sports health tragedies as well.

There are several types of heart conditions that can suddenly affect an athlete. All are potentially deadly in the wrong circumstance (under stress, such as a dehydrated state), and most can be easily over-looked or not present at all at the time of a physician's sports physical. The sport's physical, as mentioned earlier, is a screening battery of tests- and not intended to pick up every problem. A cardiac abnormality may be the most dangerous thing to "not pick up", but also the hardest thing "to find"- even with the best doctor and the best sport's physical exam. This is because sometimes the condition can not be heard at rest, or possibly not something that can be heard at all.

The statistics show, like in most diseases, being involved in a car accident is more likely to cause death than dying from a heart abnormality.



**Still, athletes should be cautious and seek medical advice if they have chest pain, chest tightness, shortness of breath, dizziness, fainting, or cough with exercise.**

They should also have a cardiac work up if there is family history of sudden cardiac death under the age of fifty years. One in 300,000 female athletes is at risk for sudden cardiac death while one in 100,000 male athletes is at risk. Approximately one hundred athletes die annually in the United States from sudden cardiac death; about twenty five of them are in high school or college. As a comparison, the CDC offers statistics of almost 14,000 deaths in the United States due to motor vehicles. (CDC 2004).

## **Anatomical problem:**

**Aberrant coronary artery-** an artery feeding the heart with oxygen is in the "wrong place" and is compromised during a large cardiac need (usually during exercise with fast heart rate). Can be detected with echocardiogram.

**Coarctation of the aorta-** a narrowing of the largest artery causing dangerous blood pressure abnormalities. Can be detected with echocardiogram

**Atrioseptal defect/Ventricular septal defect:** holes in various locations inside the heart chamber causing blood flow to be deviated. Can be detected by echocardiogram



## **Conduction problem:**

**SVT- supraventricular tachycardia-** a fast heartbeat due to an aberrant or accessory node of activity different than the expected “sinus node” where the normal heartbeat is expected to begin. Can be detected by ECG (EKG)

**Atrial fibrillation-** a fast irregular heartbeat from an aberrant area of activity, a medication or illicit drug, or an illness that affected the heart. Can be detected by ECG.

**Ventricular fibrillation-** deadly within minutes- an erratic heartbeat from oxygen deprivation to the heart muscle, an injury to the heart such as a baseball hitting the chest (commotio cordis), a prolonged injury such as a drowning, asphyxia, excessive trauma, prolonged oxygen deprivation, or electrocution. Can be detected by ECG

## **IHSS: Idiopathic hypertrophic subaortic stenosis: Hypertrophic cardiomyopathy:**

Effecting 1 in 500 people (not everyone with IHSS has symptoms and some never have a life threatening occurrence), this genetic problem is the “nightmare” for every physician doing sports physicals. It comprises approximately half of the sudden cardiac death in young athletes.

Children with a family member who experienced sudden cardiac death (especially before the age of 50 years old) should be examined by a cardiologist along with their family physician or pediatrician. Said simply, this is serious business.

For many reasons (one is genetic- scientists have found some cases due to an autosomal dominant inherited trait), the septum- the center of the heart muscle that separates the ventricles begins to thicken. This septum becomes large enough to block the opening from the left ventricle to the aorta- the large vessel carrying oxygenated blood to the rest of the body, including the brain and heart muscle itself. To fully understand this deadly problem, you must realize that the heart muscle, filled with blood, must have oxygen itself to continue pumping. These coronary vessels branch off the aorta and “feed” the heart.

At a critical time, under stress, the aorta receives so little blood from the left ventricle due to a “hypertrophic” (enlarged) septum that the “stenosis” (narrowing) to the aorta results in the heart itself deprived of oxygen, resulting in ventricular fibrillation and death within minutes. Defibrillators on the field offer survival to a moderate percentage of victims.

Unfortunately, even the best pediatric cardiologist can miss the murmur, heard best when an athlete goes from a squatting to standing position. Symptoms such as

faintness with exercise, chest pain, and dizziness with exercise can prompt a more exhaustive examination. ECG (electrocardiogram) and x-ray may show an enlarged heart, but the best test is a cardiac echocardiogram (ultrasound). In some countries (Italy for example), all high school athletes receive a pre-season screening echocardiogram to measure the septum between the ventricles. They also receive an ECG to look for conduction abnormalities such as prolonged QT syndrome. The United States medical system does not find this test cost effective for the relatively large number of athletes and relatively rare occurrence of sudden death on the field.

Treatment, if found, involves restriction of any exercise causing an accelerated heart beat or increased stress to the heart. This is a rare diagnosis where exclusion of patients from certain sports can be life saving. Children with IHSS might consider golf, ballet, or non-competitive tae kwon do.

In my opinion, it is a shame to have a child become mentally and physically attached to a game such as soccer at eight or nine years old and then be told they can not play for risk of a fatal event when diagnosed with IHSS at fifteen or sixteen years old. It is far more acceptable to offer them a sport that they can participate in safely and become excited about from the beginning, without having to stop an aerobic sport they initially started but are now asked to quit. This can cause mental stress- even depression in some cases. If there are risk factors, check athletes early, perhaps eight or nine years of age.

Other treatments involve medication, internal defibrillators, and rarely surgery.

My recommendation is to have children -with parents or grandparents previously diagnosed with IHSS- to receive a screening echocardiogram at age eight or nine years old (before most children are “attached” to any one sport). If the problem is present, this gives parents an opportunity to pick safe activities without the struggle of changing sports once the child is mentally attached to a particular sport, team, or life-style.

The truth though, is that IHSS becomes most obvious in adolescence-sometime between thirteen and eighteen years old. Therefore, if at age ten the heart appears normal, the echocardiogram must be repeated during the teenage years and then annually during the high school and college years in athletes with a family history of cardiac caused death before age fifty or with a family member with known IHSS.

Thankfully, the echocardiogram is relatively inexpensive, completely non-traumatic for the child, and extremely sensitive at picking up an enlarged septum.



**An echocardiogram is the best tool in detecting idiopathic subaortic stenosis, also called IHSS, or hypertrophic cardiomyopathy.**

If there is no family history, but symptoms such as chest pain, faintness, or dizziness exists, a pediatric cardiologist should become involved to help make decisions of further testing.

And finally, without family history or symptoms, thankfully, this problem is extremely rare and no testing needs to occur except for a heart examination by a primary care family physician or pediatrician.

Deaths from IHSS are uncommon but obviously devastating- and always a story in the media causing fear and appropriate sadness. A sports physical remains an important, but not perfect part of pre-participation- especially for children with a family history of any heart disease occurring before the age of sixty years old (including cholesterol disease) and any sudden death in a family member before the age of fifty years old.

**Family history of cardiac abnormalities or an athlete’s symptoms of chest pain, fainting during exercise, or dizziness with exercise are clues that further work up should be done. This “large heart” is NOT the same as “grandma’s large heart from congestive heart failure”.**

**Future discussion:**

There is discussion of having baseline testing done for athletes in the United States that is similar to that done in Italy.

The largest factor prohibiting it is cost.

Another negative is the possibility of false positives (a screening test states there is something wrong necessitating further work up, which becomes stressful for the patient and often costly). Once the further testing is completed, everything is found to be normal.

False negatives, or missing a case, have medical-legal implications that would need to be addressed. Some health care providers believe that the cost, false positives, and false negatives warrant a second look before routine baseline testing is recommended. Other doctors believe starting baseline ECG and echocardiogram testing has the opportunity to save lives and should be a part of the sports physical.

**Possible future screening tests done in conjunction with a sports physical**

- Cardiac testing- ECG, blood pressure, and echocardiogram
- Concussion screening- ImPACT™, and balance testing
- Laboratory testing- cholesterol, Vitamin D, sickle cell trait
- Functional joint and muscle testing- flexibility, strength, balance

## **Dehydration:**

Although rarely a pure cardiac event, dehydration can lead to brain, kidney, and heart injury. In prolonged or severe dehydration, the heart can increase its rate fast enough (in attempts to circulate a smaller amount of fluid more quickly) to cause a deficit in pumping oxygen rich blood to its own muscle- starting a downward spiral resulting in ventricular fibrillation.

**The bottom line is ensuring the athlete is able to get water.**

**Caffeinated beverages, alcohol, and those with caffeine and taurine increase the chance of dehydration.**

**Dehydration is ALWAYS a preventable problem and NEVER an accident!**

See chapter on hydration during sport.

## **Abdominal Pain:**

Stomach aches are very common in every group of people- athletes can be burdened with a stomach ache that can ruin a practice, or worse, an important competition.

The reasons for stomach ache are extremely long, and depend on the age of the athlete. This chapter will discuss only the most common reasons. Each case must be evaluated by a medical professional.

### **Warning Signs for Abdominal Pain**

Fever above 100.5  
Severe abdominal pain, hurts to jump  
Vomiting with severe pain  
Blood in urine or stool

### **Causes of Abdominal Pain**

This is not a complete list

### **Surgical Causes of Abdominal Pain, often with vomiting**

<b><u>Problem</u></b>	<b><u>Place</u></b>	<b><u>Typical Age</u></b>
<b>Appendicitis -</b>	lower right –	any age
<b>Volvulus -</b>	lower-	young
<b>Intussusception-</b>	lower-	young, adult if from cancer or polyp
<b>Splenic rupture-</b>	upper left-	adolescent
<b>Kidney Stones-</b>	back and groin	any age

### **Infectious Causes of Abdominal Pain**

<b><u>Problem</u></b>	<b><u>Place</u></b>	<b><u>Other signs</u></b>
<b>Viral</b>	upper/lower	<b>possibly with vomiting or diarrhea</b>
<b>Food Poisoning</b>	upper/lower	<b>possibly with vomiting or diarrhea</b>
<b>Strep Throat</b>	upper	<b>normally with no diarrhea</b>
<b>Pneumonia</b>	upper	<b>normally with no diarrhea</b>
<b>Spider Bite</b>	lower	
<b><u>All can occur at any age</u></b>		

## Other causes of abdominal pain

<b>Problem</b>	<b>Place</b>	<b>Typical Age</b>	<b>Common?</b>
<b>Functional</b>	upper	after age 4	Very common
<b>Inflammatory</b>	lower	after 16	Not common
<b>Medicines</b>	upper	any age	Very common
<b>Constipation</b>	lower	any age	Very common
<b>Lead and environmental exposures</b>		any age	Not common
<b>Abdominal migraine</b>	upper	early adolescent	Not common
<b>Ulcer and Reflux</b>	upper chest	any age	Common
<b>Gynecologic in females</b>	lower	adolescent	Common
<b>Diabetes Mellitus</b>		any age	Not common
<b>Porphyria</b>		any age	Rare
<b>Celiac Disease</b>		any age	Not common
<b>Spider Bite</b>		any age	Rare

### **Functional Abdominal Pain**

This is the most common reason for athletes to have upper abdominal pain and it is sometimes the hardest to treat. While it is a rule out diagnosis (you must ensure it is nothing else and there is no lab test or x-ray to prove it)- it is seen in every sport, in both girls and boys of all ages- recreation to professional level.

Functional abdominal pain in children is similar to irritable bowel syndrome seen in adults. Functional abdominal pain can start in childhood- as early as four or five years old. Anxiety, excitement, competition, fatigue, and desire for approval by parents, coaches, or team-mates are all triggers. Abdominal pain, vomiting, and diarrhea are all possible symptoms. Often symptoms are so bad they are mistaken for surgical causes and emergency room visits take place. This REAL and painful situation causes distress in the athlete and the parents- who are usually reluctant to believe that the pain is not from something like the appendix, an ulcer, or even cancer.

Often thousands of dollars of testing is accomplished with no diagnosis. If the athlete is growing well, hydrated, has a normal hemoglobin (not anemic) and normal stools (no blood or mucus)- it is unnecessary to run a battery of tests in most instances. Even when reassured by a physician, often parents push the medical professional to keep looking for a mysterious cause.

A calendar to document when the abdominal pain occurs can sometimes assist in noticing the repetitive and predictable occurrences. Coaches, teachers, and parents need to work together to “track” this with a “diary of pain.”

Treatment involves trials of medication including anti-ulcer medication, anti-anxiety medication, and sometimes serotonin reuptake inhibitors. Sports psychologists and a supportive medical professional can assist in treating the patient while explaining to parents and coaches the reality of the pain even without a specific diagnosis.

Professionals can also reassure the athlete that their pain is real- and believed- although not dangerous, and treatable for success in their sport and their non-sport life.

Athletes who are determined to get better and parents who trust the diagnosis almost 100% of the time improve and return to sport.

### **Functional Abdominal Pain**

**Symptoms:** Recurring crampy abdominal pain at the umbilicus or slightly above  
No fever but may have vomiting and/or diarrhea

**Who gets it:** Anyone, usually 7 years and older with “type-A” personality

**Tests:** History and physical exam is all that is necessary

Medication, relaxation techniques, psychology

### **Warning signs that it isn't Functional Abdominal Pain**

Loss of weight

Fever

Blood or mucus in stools

**Treatment Strategies** See page 7 for info

**Medication-** 5- can be helpful

**Surgery-** 0- never appropriate

**Psychology-** 5- very helpful

**Chiropractic-** 3- not usually helpful

**Diet Changes and timing of when to eat-** 3- can be helpful

### **Surgical Abdominal Pain:**

This type of abdominal pain is potentially life threatening and must be evaluated immediately. Thankfully, it is not the most common reason for abdominal pain in adolescents.

**Appendicitis** is the inflammation and eventual rupture of the small organ at the lower right side of the intestines. In a very small percentage of the population, the appendix can be found on the left lower side of the abdomen.

It is the most common reason for abdominal surgery in the adolescent but far less common than non-surgical reasons of abdominal pain such as functional abdominal pain and constipation.

The appendix is above the pelvic bone, and just to the right and below the umbilicus (belly button). During inflammation pain typically begins at the umbilicus (belly button) and then shifts to the right lower side of the abdomen. It is associated with fever, nausea, and vomiting.

### **Appendicitis**

**Symptoms:** Severe abdominal pain, fever, vomiting

**Effects:** Any age

**What to do:** Go to emergency room, ultrasound, CT scan, blood work

**Treatment:** Surgery-5

While surgery is always the treatment, some patients may have to wait for the area to calm down before appendectomy. If the appendix is inflamed or newly ruptured, often surgery is immediate. If the appendix ruptured already and antibiotics can calm the area down, it can make surgery easier. Younger patients are typically those that may undergo delayed appendectomy, while older adolescents and adults almost always have surgery once the diagnosis is suspected/proven.

Other reasons for surgery include volvulus (a twisting intestine) and intussusceptions (an intestine that telescopes into itself) which are both more common in young children and those with complicating factors such as cancer if found in a geriatric patient.

## **Infectious Causes of Abdominal Pain**

### **Mononucleosis:**

**Splenic rupture** may occur in an athlete with **mononucleosis**, epstein barr virus (mono). This virus changes the shape of red blood cells. The patient may feel fatigued, have a fever, sore throat, and large glands (lymph nodes) and have upper left sided abdominal pain. The spleen (an organ in the upper left side of the abdomen) enlarges as it attempts to catch or filter the mono affected red blood cells- sometimes doubling or more than normal size. 50% of adolescents may have an enlarged spleen, most often during the first three weeks of illness.

The rib cage acts as protection for the heart, lungs, liver, and spleen. During mono, the spleen may enlarge and “drop” below the protective ribs. It is like a “water-balloon” organ filled with filtered blood. If struck, it can “pop” (rupture), causing an emergent, life threatening, and extremely painful situation.



Surgery is absolutely necessary. Although the spleen can spontaneously rupture for no reason, mono is the primary cause for athletes to have an enlarged spleen with risk for rupture, and must be withdrawn from contact sport while the risk is increased. Physical exam in all instances, and ultrasound or CT in some special circumstances, can help determine the size of the spleen and the safest time for return to sport.

### **Food Poisoning:**

While **food poisoning** is often blamed for a night of abdominal pain and vomiting- it is more likely a **viral infection**. There are the unfortunate stories of a team going to a restaurant and the entire team getting ill after eating the dessert. It is best, especially when traveling outside the country, to drink bottled water and ensure meats are well cooked. Salad bars, buffets, and food handled in unsanitary environments (the park, outdoor “hot dog stands”) increase the risk for food poisoning. Antibiotics are appropriate in some situations while others must just “run its course”. A medical professional should be consulted to ensure there is no dehydration and to offer any possible treatment.

### **Viral gastroenteritis:**

**Viral Gastroenteritis** is extremely common. It too can effect an entire team although normally one person at a time. Fever, vomiting for one to two days, followed by up to one week of diarrhea is typical. Good hand washing and separated living quarters decreases the risk of spreading the virus. There is no treatment except good hydration. In fact, medicines to slow diarrhea are not recommended as they only prolong the viral episode. Stopping the vomiting can be as simple as slow frequent oral replacement with water or electrolyte drinks (such as Gatorade or Pedialyte)- a tablespoon every 30 seconds until the patient urinates may be all that can be tolerated. If this is unsuccessful, IV fluids, and anti-emetic (anti-vomiting) medication may be necessary to avoid dehydration.

**Strep throat and pneumonia:** (especially right sided pneumonia) can be associated with upper abdominal pain. In fact, a young child with fever and abdominal pain (who can't or doesn't know how to complain of a sore throat) should be considered for strep throat along with other causes for abdominal pain.

### **Other infectious/poisonous causes:**

Although unusual, **spider bites** can cause severe abdominal pain. Patients with a bite and abdominal pain should seek medical attention- as problems with kidney, muscle break down, and liver enzyme elevations can occur in Black widow and Brown Recluse bites.

## **Other causes for Abdominal Pain**

### **Inflammatory bowel disease: Crohn's disease and Ulcerative Colitis.**

Most commonly diagnosed in late teens or early twenties- these two diseases are associated with lower abdominal pain, often bloody diarrhea and loss of weight,

and sometimes joint pain, mouth ulcers, or rashes. A medical professional and testing such as CT scan, colonoscopy, and blood tests will help determine these diseases that are treated with medication and sometimes surgery.

**Constipation** is an often over-looked reason for mild to even severe abdominal pain- usually causing cramping but sometimes even causing vomiting.

Constipation is extremely common- especially in athletes traveling and uncomfortable with their surroundings or simply don't have time (or are not allowed time) for what they are familiar with at home when they feel the urge to have a bowel movement. Some athletes do not drink enough water. Lastly, athletes may not have enough vegetables, fruits, and other natural foods.

Although a daily bowel movement is not required, the stool should be soft and painless. Most people have at least one stool a week. If it is hard or strained, the child may withhold on the next urge to go to the bathroom. This causes a “cycle of constipation” until finally the “backed up” stool is released and is even more uncomfortable than if the child had gone at the first urge. This convinces the child that going to the bathroom is painful and so the cycle continues.

Medication and good bathroom hygiene are treatments. Exlax and other stimulant laxatives are reserved for unusual circumstances while Mineral Oil, Milk of Magnesia, and safer laxatives such as polyethylene glycol (Miralax and Glycolax) and lactulose (Kristalose) are used first line in pediatrics and adolescence.

### **Polyethylene glycol (Miralax)**

Now an over the counter medication, Miralax, is a safe and affordable treatment for constipation. Ask your doctor if it might help your athlete with constipation and/or encopresis (stooling in pants)

Any **medication** can cause upper abdominal pain. All antibiotics and non-steroidals such as ibuprofen or naproxen are common culprits. Cox 2 inhibitors such as Celecoxib (Celebryx) are less irritating to the gut but not FDA approved for all age groups. Antibiotics also have the potential side effect of diarrhea- the most serious called Clostridium difficile diarrhea- and requiring medication (another antibiotic, believe it or not!) and possible hospitalization.

**Ulcers and gastrointestinal reflux disease** are possible causes of upper abdominal pain. Appetite changes (reduction in chocolate, caffeine, alcohol, and spicy foods in some people) may help with symptoms. Others may require medication such as Histamine II blockers (like Ranitidine (Zantac) or proton pump inhibitors like lansoprazole (Prevacid) or omeprazole (Prilosec).

Cough, chest pain, and asthma type symptoms may be clues to reflux as well. In fact reflux can be the “trigger” for asthma symptoms. Research in dogs have shown a direct link between reflux and asthma- probably due to the vagus nerve.

Females may have *lower abdominal pain* due to **gynecologic disorders** such as premenstrual cramps, abdominal pain in the middle of their cycle (middleschmerz), ovarian cysts, and pelvic inflammatory disease if sexually active.

**Abdominal migraine** is a little understood cause for *upper abdominal pain*. Similar medications are tried as those with headache type migraine as well as avoidance of “triggers” that might be found to increase the occurrence.

**Allergies and Sensitivities to food** Milk allergy and wheat (Celiac disease due to gluten sensitivity) can cause abdominal pain and diarrhea. There are of course other foods that can cause allergy problems.

All cases of abdominal pain should be evaluated by a medical professional. Often a simple treatment can save missed practice and competition... and pain!

## **The Skin: MRSA, Fungal Infections, and Warts**

As the largest organ of the body, and the most obvious to see its health- or disease state- the skin is often the controversy of an athlete's participation status- and often an unsightly but minimal problem rather than a dangerous one.

### **MRSA:**

Methicillin Resistant Staph Aureus is a bacterial infection that can not be treated with the typical antibiotics used to treat skin infections- such as Penicillin, cephalexin, and erythromycin. Sulfas and clindamycin must be considered with their increased side effects along with vancomycin, a much more expensive choice that must be protected from over use so that it does not one day have bacterial resistance. (such as Vancomycin Resistant Enterococcus (VRE).

Red pustules with drainage should be cultured by a clinician and treatment should be aggressive to reduce the chance for spreading it to family and other athletes. Cultures take between 24 and 72 hours to complete and it is impossible to be certain of the organism causing the infection without this test. Guaranteeing the correct treatment requires proper identification and intense treatment with oral and topical antibiotics, draining abscesses, as well as preventative techniques to reduce its spread.

Preventative techniques involve novel bathing with bleach water, nasal antibiotic usage, and seemingly neurotic cleaning to prevent the entire family becoming infected. And although it is usually a mild skin infection- MRSA rarely can become a life threatening infection requiring hospitalization.

### **Warts and Molluscum Contagiosum:**

Both warts and molluscum (water warts) are from a virus, common in children and usually "worn out" by adulthood. Warts, although not dangerous, can cause social anxiety and mild discomfort. Some are infected with only a few lesions for a short time while others have dozens of lesions lasting years. Almost always the virus will disappear, without treatment or scarring by late teens to early adulthood.

While mildly contagious, warts cause no concern for overall health in team mates or opponents. Most athletes and parents are not patient in awaiting their disappearance.

Treatments include topical such as duct tape (yes it can hasten both the common wart and molluscum clearing), freezing (cryotherapy), and curettage (cutting the wart out), and injection with Candida (a yeast that "revs" up the patient's immune system, showing the immune system where the wart is, it typically takes two to three injections before improvement). Molluscum can be destroyed with blister

beetle extract (canthandorin) while warts can not. Imiquimod (Aldara), approved for genital warts, has been used by some clinicians for common warts. Oral treatments include cimetidine (Tagamet) with moderate success. All treatments are permanent but can take up to 4-6 months for success.

### **Fungal Infections:**

Usually a concern for wrestlers, fungal infections can prohibit competition. While relatively easy to treat- delay in diagnosis can be from avoiding a doctor's appointment, mistaken for another cause such as eczema or dry skin, or simply overlooking the lesion.

Culture can be useful in cases where typical topical treatment is unsuccessful. Often the over the counter medicine, Clotrimazole (Lotrimin) is enough to rid of the lesion.

# **Stress Fractures in the Adolescent Athlete**

One of the most intriguing injuries in adolescent sports medicine is stress fractures. In the last decade, stress fractures have not only increased in numbers seen by each physician, but have also become more common in every youth sport- regardless of level or age.

The cause for this significant increase is under debate. Here is a good but certainly not exhaustive list of why doctors believe there is an increase in stress fractures among America's young athletes-

## **Skill/Training/Expectations**

- Increased number of hours of practice and competition (up to 40 hours per week in some instances)
- Increased number of skills/increased degree of difficulty expected (today's premier level athletes are competing same skills that only Olympians did merely years ago)
- Skill requirement required too stressful for growing joints/bones/muscle (increased difficulty and increased "pounding")
- Either voluntary or involuntary (per coach or parent) continued participation during injury/incomplete recovery resulting in stress fracture
- Improper technique in lifting for example or excessive numbers of the same skill increases the risk for stress fracture

## **Nutrition/Diet**

- Decreased caloric intake of high level athletes due to parental/coach pressure or athlete's own misinformation about nutrition and the advertising of smaller, thinner models (calories and a percentage of fat required for healthy muscle growth and bone health)
- Decreased calcium and Vitamin D intake compared to muscle and bone requirement
- Dark soft drinks (with phosphorus) may "steal" calcium stores.

## **Hormones**

- In females, estrogen is a "bone hardener". At Tanner 4 (the puberty maturation scale when an adolescent female starts her menses) growth plates begin to close- allowing females to reach their adult height and the relatively soft bone gets stronger (more adult-like)
- Because both girls and boys are doing harder skills with more impact at a younger age (when bone is relatively soft and well before Tanner 4) and many competitive athletes are practicing and competing for more hours per week, there is a relatively increased risk for stress injury.

- A poor caloric intake results in decreased estrogen in women, eventually an irregular menstrual cycle, and thus abnormal estrogen balance resulting in a relatively increased risk of stress fracture.

### **Medical Reasons**

- Better diagnostic tools- MRI more accessible to find stress fractures once overlooked
- Physicians interested in sports medicine more likely to find diagnosis than simply ask athlete to rest and not determine actual diagnosis.
- More competitive athletes looking for medical assistance to return to full sport's potential rather than playing injured or not at 100%

There are other reasons, most notably, “we don’t know why” there are so many more stress fractures... but there certainly are!

### **The science:**

Fractures are relatively easy to see. Parents, coaches, athletes, and doctors can diagnose the broken arm on the field if there is misalignment or obvious deformity. The x-ray shows the fractured bone and the treatment almost always results in immobilization by a cast.

Soft tissue injuries are also typically easy to diagnose. The x-ray is normal. The physical exam shows bruising and tenderness over the injured muscle, tendon, or ligament. Rest is typically the treatment along with physical therapy for a quicker return.

But the stress fracture is often an enigma. Athletes in every sport continue practice and competition with pain, reduced speed and strength, and sometimes a change in mental sharpness—because of some undiagnosed “pain”.

The x-ray is almost always read as normal- and often even after the diagnosis of a stress fracture is made- the repeat viewing of the plain x-ray does not show even a hint of the injury. The radiologist did not “miss” the fracture—it just wasn’t visible on the x-ray.

And if the physician stops there- the stress fracture will not be diagnosed. The pain will continue for months, and the athlete will plateau or decrease ability rather than improve. It becomes a frustrating, debilitating and painful season.

Thus a painful extremity/back/joint that has a normal x-ray should have a repeat x-ray in 1-2 weeks- looking for bone healing. Repeated x-rays can pick up subtle hints of a healing stress fracture at 7-14 days after the pain was first noticed.

Bone scan and MRI are much more sensitive and accurate at diagnosing stress fracture injury- but also more complicated and expensive.

It is extremely important, from my perspective, to get an accurate diagnosis.

Here is a vignette to explain why:

**Example A:**

Amber, a fourteen year old premier level soccer player has three weeks of heel pain. The initial diagnosis was Achilles tendonitis versus Sever's disease. She began physical therapy, wore a gel heel cup, iced after practice, took ibuprofen and continued playing in tournaments.

Her pain seemed to improve from a 7/10 to a 5 or 6/10 but never less. (My goal is obviously to get athletes to a 0/10 pain, but at least to a 3/10 pain and no limp for continued participation in sport).

The final tournament, only five weeks away, was out of town, and it was important to have Amber at 100% since she was the highest scorer on the team. Her coach believed she was at 60% and Amber's mother believed she was at about 30-40%. Amber stated that she had good practices and bad ones, but had not had a pain free practice for about two months.

Physician A took an x-ray- which was normal. He stated that she should rest for two weeks, continue physical therapy and Achilles stretching, ice and ibuprofen. He believed she would be better by the tournament and could restart practice in about three weeks- allowing her to have two weeks to train before competition.

Indeed Amber followed instructions closely and took two weeks off of practice while continuing physical therapy. Things seemed to improve with pain only a 2/10 with walking at home. The pain never exceeded a 3/10 in physical therapy. But when she returned to practice (and only 2 weeks until tournament time)- her heel pain returned to a 6/10 and her coach even noted she seemed to be limping.

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Physician B also took an x-ray- which was normal. But because of the length of time the pain was present and the minimal improvement with current treatment- he elected to MRI Amber's foot and heel. The MRI revealed a stress fracture not evident on the x-ray.

Here is where the treatment- and the overall success of Amber's final tournament takes a change...

Physician B removed Amber from sport and placed her foot in a cam walker walking boot for three weeks. It was disappointing for Amber and her parents and nerve-racking to think she was being immobilized so close to a big tournament. After three weeks (and only 2 weeks before the tournament), Amber started



physical therapy for Achilles stretching, re-strengthening of the ankle, and proprioception of the foot.

She returned to practice ten days before the tournament with 0/10 pain and a complete resolution of symptoms.

As you see- the correct diagnosis required more testing (an MRI), more treatment (a walking boot), and more aggressive rest (three weeks completely off)- doesn't sound very sports friendly at first glance. But because of the accurate diagnosis- Amber returned to sport completely free of pain, where-as the first treatment by Physician A (while less restrictive) resulted in a return of all symptoms even with the treatment followed. And... no way for resolution before the tournament.

I think this topic is so important- I want to review another case or two just to "keep us on the same page". Because some people reading this may be interpreting "less treatment is better" in sports medicine... and the truth is... every situation is different. "Good medicine" is not necessarily a lot of medication versus no medication- nor is it a lot of tests or surgery versus no tests or surgery. "Good medicine" evaluates the problem and attempts to manage it with the sport's schedule and the athlete's goals and safety in mind. Sometimes the same diagnosis for one athlete is treated differently than another athlete, and both are treated appropriately for their situation.

**Example B:**

Edward, a twelve year old football player began having back pain one month ago. He hated to tell his mother because he loved "his job on the field". He was the only member of the team who hiked the ball to the quarterback- the center position was something he felt pride about.

But every time he tackled the opposing player after hiking the ball- he had low back pain.

Finally, his mother took him to the doctor after Edward admitted he had pain for several weeks.

X-rays were normal.

**Physician A** had him rest for two weeks and attempt to return to practice. After two weeks of "insanity at home" because he was so unhappy missing practice- he returned to the field. The first day of practice his pain returned- as if he had never taken a break.

**Physician B** started him in physical therapy- which didn't help, in fact, after three visits it made his symptoms worse! A bone scan was ordered and showed a stress fracture at L5/S1 (a spondylolysis). Edward was braced for two months and then allowed to return to physical therapy and to sport- completely pain free.

Once again- a more aggressive treatment and seemingly more restrictive- but the treatment was ordered quickly and resulted in pain free activity rather than weeks... or months of continued pain and decreasing performance.

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**Example C:**

Brittany is a sixteen year old dancer. She has had foot pain for three weeks. Once again, x-rays are completely normal. She was told that it was likely a sprain and symptoms would improve with physical therapy and relative rest.

Two weeks later, her pain continued and an MRI was ordered. The MRI showed a ligament injury between the second and third metatarsal- a lisfranc sprain. A foot orthopedist was consulted and eventually surgery was necessary. This debilitating and often misdiagnosed injury can cause months of pain before proper treatment. While looking for a stress fracture- which is more likely- the physician may find something different- but still looking (an MRI in this case) was the important thing.

**If the MRI is normal- was it a waste of money and time?**

Even with a normal MRI- if the story suggests the possibility of a stress fracture, it is worth looking. The normal MRI will reassure the coach, parent, athlete, and doctor that nothing has been missed and aggressive rehab and continued participation in sport is safe while not further injuring an otherwise overlooked diagnosis.

With all of these examples- it may appear that an MRI is necessary in every case. It isn't! A good history and physical exam, a positive finding on x-ray, or an "obvious" story for something other than a stress fracture may result in a completely appropriate but different plan of treatment.

Finding a sports friendly physician with an interest in the athlete is far better than telling your doctor, "You must order an MRI!"

**Warning signs of things that mimic stress fracture**

**This needs further workup if:**

- Fever and bone pain (especially at night)
- Limp
- No injury or trauma but bone pain for over two weeks

**"Growing Pains" rather than stress fracture, typically no further workup necessary:**

- Legs hurt at night, bone pain, but alternate to both legs- better during the day and NO FEVERS or limp or weight loss
- Achy calves that improve with massage, usually only at night

## **RULE OF THUMB:**

Kids should not limp or refuse to use their arm/leg... get a diagnosis!

### **Questions to ask your doctor:**

1. If the x-ray is normal- how long do we wait to repeat x-ray or get a further test such as a bone scan or MRI?
2. If we find a stress fracture, how will we treat it?
3. If immobilization is necessary, for how long and will we need physical therapy afterwards?

### **Warning signs of a stress fracture**

More than two weeks of “bone pain”

Limp, pain over a 5/10

X-ray normal but treatment suggested doesn't help after two weeks

Pain all times of the day, not just with activity

### **Important things to consider if your child has a stress fracture:**

**Calcium and Vitamin D is a must!** Unless your child has a history of kidney stones, kidney disease or contraindication for calcium- then 1000-1500mg of calcium and at least 400-800 international units of Vitamin D is a must! 1000 IU of vitamin D twice daily is suggested by some sports interested doctors.

If the vitamin D level is checked and found to be low (under 32) then even higher doses can be considered (up to 50,000 IU per week for a period of 2-3 months)

\*Check with your doctor, as dosing recommendations do change.

**Bone density** is recommended in my office if an athlete has had more than one stress fracture. A baseline bone density (DEXA scan) is compared to one a year later to ensure bone health is stable or improving.

**Nutrition consult-** more than one stress fracture is absolutely a warning sign that diet is a possible problem. Premier level athletes need calories, fat, and higher amounts of calcium/vitamin D. Even excellently educated parents and coaches may not realize that their child's diet is not “sports-friendly”.

A normal appearing athlete may still be calorie deficient! Growing muscle and bone to keep up with height increases, puberty, and the sport require MORE calories than you think- see the information on nutrition in the athlete.

# Physical Therapy with Adolescent Athletes

Like a hammer is a needed tool for a carpenter, and a tire wrench an important tool for a mechanic--- the physical therapist is an important tool for any health care provider helping an injured athlete.

Every primary care physician interested in sports medicine, every surgeon following a surgery case, and every athletic trainer helping an athlete on the sideline depends on the physical therapy team.

Physical therapy is based on several models. Some models work better for people recently out of surgery, others who recently became weak from an illness or being bed-ridden, and still others that are injured during work or sport.

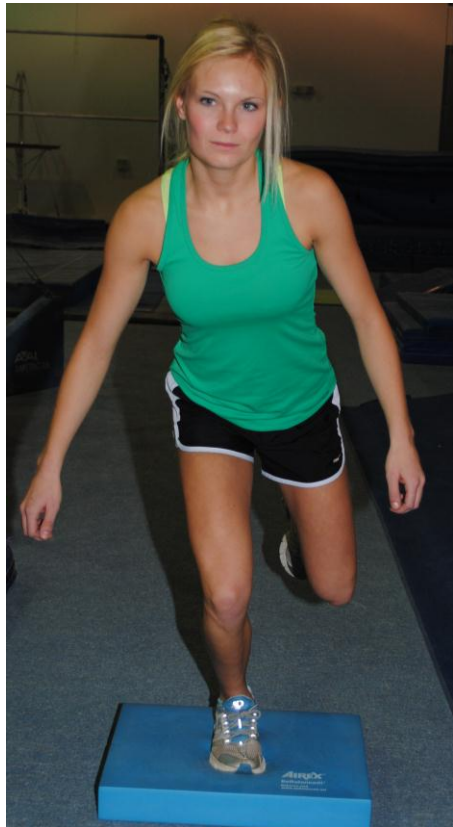
Each concentrates on the muscle and bone structure of the body- and relates to the function of the muscle, along with its flexibility and strength. Exercises (modalities) along with therapies

(heat/ice/ultrasound) are used to increase range of motion, strength, flexibility, and overall use of injured, repaired, and weak muscle.

Here are a couple of words that will help you communicate with your physical therapist and doctor.

**Proprioception:** the activities your muscle undertakes to remember how to best function (muscle memory). The easiest example is to have you close your eyes, extend your arm out to the side – then bend your arm and touch your finger to your nose. How, with your eyes closed, did you find your nose? Of course you “remembered” where your nose was... more specifically, your brain told your arm to bend your elbow and place your finger in the location you recalled your nose would most likely be!

Now repeat the trick while standing on one foot. A bit harder?



Now once more, repeat the trick while standing on an uneven surface such as the step, a soft pillow, or the edge of a curb. Each of these require more muscles to activate and “remember” how to work while getting your hand to your nose without the sense of sight.

Physical therapy assists you in regaining proprioception more quickly- it is something that is lost after an ankle sprain, a knee surgery, or time off of activity during bed rest or illness. While proprioception will regain itself over time, physical therapy greatly hastens its recovery- making the athlete safer to return to sport sooner and less likely to reinjure the once weakened area. Imagine a twelve year old premier level athlete running down the soccer field and spraining his ankle. There is instant pain, swelling, bruising, and inability to continue playing.

The next day the swelling is improved but there is still pain and the inability to walk without a limp.

X-rays are normal and the doctor has several choices. By the way, x-rays are not always necessary but the doctor chose to do them in this case to check the growth plate for injury.

A. Take two weeks off, wrap and ice the ankle to reduce swelling, crutches if it is painful to walk and return to sport when pain-free... which may take one to four weeks.

In this scenario, while keeping the athlete safe from reinjury- the plan actually delays recovery. And even more worrisome- when the athlete returns to sport- he may be pain-free but also weak and have a reduced proprioception making it more likely for a secondary injury on the first day back!

B. Another approach may be something like this...

Ice and wrap the ankle for one to two days while going to physical therapy for water therapy, massage and other modalities for reduction of inflammation. Start passive range of motion and stimulation of the nerves and muscles in the injured area within one to two days. Exercises and weight bearing may take place within the first week and harder exercises requiring angled movements, stepping up and down, and planting/cutting drills may follow over the course of one to two weeks. These activities not only help resolve the actual injury, but also protect from repeating it once returning to the field. They are called functional because they involve the same function of muscle use during actual sport. They are called multi-planar because they are in every plane of motion (sagittal, coronal, transverse). They are called proprioceptive because they involve retraining the muscle and nerve to communicate. And it is rehab because the exercises are being done after an injury and being used for rehabilitation rather than prevention... therefore your physical therapist is **doing multiplanar functional proprioceptive**

**rehab.** This is different than the “old” theraband exercises while sitting on a training table- which are NON functional and SINGLE plane proprioceptive rehab.

And during treatment, the physical therapist can re-evaluate the athlete on a week by week basis until judged safe to return to competition where he will once again be placed in an environment where the field may have holes and ruts, he may get kicked or tripped, and he will be pushing himself to his limits. Proprioception is key for success.

In the “old days”, proprioception, strengthening, and flexibility were taught with exercises using therabands and rubber bands. While these tools remain important in the physical therapists office- other tools have taken over the “grunt” work for the healing athlete. Wobble boards, star designs on the floor, and multi sized steps offer far more variety and “natural” movements expected by the athlete once they leave the physical therapist and return to the “real world”.

This **functional** (real life), **multi-planar** (not just sitting down doing the exercises but rather moving in all directions) **proprioceptive** (muscle memory) exercises are the best techniques for a quick return and the best protection from a new injury. Some of the exercises may even make the athlete “sore” because the injured muscles are being forced to work- but the therapist is able to evaluate the safety and likelihood of re-injury. This is better than rest alone because the therapist can judge the athlete’s strength and safety before return to full-activity, rather than going from rest and then expect the athlete to be “thrown” back in to full activity just as strong as they were before the injury.

### **Examples of Proprioceptive Exercises**

**Ankle-** balance on one foot and throw a tennis ball against the wall and catch it

**Shoulder-** get in a pushup position facing another person- give each other “5” while alternating hands.

**Knee/Hip:** while standing on one foot, bend over and pick up a basketball, place it down to your left, pick it up and place it down on your right

There are healthy, uninjured premier and professional level athletes on teams across the country doing the same exercises that injured athletes are taught in the physical therapy office. Some coaches and team doctors believe these exercises will act as preventative injury skills, adding to the proprioception and strength to muscles that are at risk. Swimmers, while strong deltoid and chest muscles, may lack strength in the tiny rotator cuff and back muscles. Rather than waiting for shoulder pain, trainers do scapular stabilizing and rotator cuff muscle exercises to prevent future injury. Gymnasts do proprioceptive exercises with their ankles, and soccer players do exercises with their knees.

As the sport's world becomes more competitive, requiring more time, and more science- athletes are depending on other resources than just their coach to "win the game".

From the perspective of a sports friendly clinician- the physical therapist is as important as any medicine or treatment plan for the injured athlete- the athlete after surgery- and even the athlete who isn't hurt at all.

**Questions to ask your doctor**

- Would physical therapy help hasten my recovery?
- Would it be better to do the physical therapy at a private sports physical therapy office?
- Is a home program helpful? Will I get as much out of it as if a physical therapist showed me?

## **Is lifting weights safe for my growing athlete?**

When making decisions on your growing child lifting weights, there are often questions about altering growth, hormones, and overall health are concerns. Coaches of various sports encourage weight lifting at ages younger than what many people think is appropriate. As a pediatrician with an interest in sports medicine, I'll share my approach; obviously there is more than one perspective on this topic.

Weight lifting has generally been a part of training for high school aged football players. It has gained acceptance in other sports over the last several years. My approach to strength training allows any athlete to participate in a conditioning program that will increase strength without risk to adolescent growth and development.

**The Basics:** Resistance training makes someone stronger when the athlete has a consistent schedule. Working out three to four times per week is better than expecting a once a month workout to make you stronger. Injuries are more common when an athlete expects to lift the same amount lifted several weeks ago without training in between. Injuries also occur without a spotter (trainer) and while showing off or max lifting (one time lift.)

**The Science:** When a muscle is asked to lift an object in repetition, blood is recruited to that area as there is an increase in oxygen demand. After several lifts- 3 sets of 15 repetitions is the goal- the muscle nears exhaustion and realizes if it is to do the exercise in the future, it will need more muscle. The muscle cells hypertrophy (get larger) and prepare for the next time. After several episodes of work, nearing exhaustion, and increased blood supply to that area- the muscle gets larger- and therefore stronger.

**How to get started-** First, anyone still growing (generally under 16-18 years old) has open growth plates. These relatively soft bones can be injured with repetitive trauma or stress. Weight training with maximum lifts (the max, or one time lift) puts adolescents at risk for growth plate injury. It also increase the risk for back injuries, hernias, and muscle sprains.

**MAXIMUM LIFTS ARE DANGEROUS for growing adolescents and not recommended in this article.**

Instead, low weight, high repetition lifts are safe and effective. Isolating a muscle group such as arm curls with a dumb-bell for the bicep muscle is a good exercise. The lift should be a slow controlled flexion of the arm with a three sets of 15 repetitions. Each athlete will be able to do this exercise with a different weight. A smaller athlete may need an eight pound weight and participate with a larger



athlete doing the same exercise using a twenty-five pound weight. If they are unable to do 15 repetitions, lower the weight and if the exercise is easy to accomplish 15 repetitions then increase the weight. Teach young athletes to think about isolating the muscle while slowly lifting the weight and slowly returning it to the starting point. Lifting weights quickly may cause the athlete to use other muscle groups and lessen the effectiveness of the lift for the muscle group they are intending to strengthen. Some people lift too much weight (only able to accomplish 8 lifts or less). Either mistake, too much weight or too fast, may cause the athlete to swing their back or their shoulder to assist in getting the arm to the flexed position. These mistakes risk back or shoulder injury and prevents the exercise from really working the intended muscle- the bicep. Athletes of all ages and levels need a trainer. Whether that is a coach, parent, or professional trainer- the athlete will benefit from the safety of someone helping lift the weights if they get too fatigued. It is also helpful to have someone watching to ensure technique is correct- slow, smooth, isolated movements. And lastly, it is a great way to spend quality time with your child.

### **THE CORE:**

The most important group of muscles to strengthen in any sport is the CORE- this includes the abdominal muscles, the back muscles, the gluteus muscles (butt muscles) and the latissimus dorsi (lats) muscles. These large, stabilizing muscle groups protect the rest of the body from injury while keeping the athlete upright on a soccer field, “tight body position” on a gymnastics floor, and “on top of the water” during a swimming competition. All the other muscles are more efficient when the CORE is strong.

While sit ups are an example of a CORE exercise, there are literally dozens of other exercises that can be done to strengthen each CORE muscle group and ensure the athlete does not get bored with a “sit up only” program. An exercise ball and light weight medicine ball can make the difference between a “boring stomach work out” and a challenging CORE program.

### **Questions: Can an adolescent actually gain strength from weight conditioning?**

Some people question if a child who is not mature (a male whose testosterone is not at adult level) gets any benefit from weight training. The answer is : Studies have been done that prove increased strength in adolescents in conditioning programs- although they do not show a large increase in muscle mass (size) until testosterone increases during puberty- young athletes do have an increase in the amount they are able to lift as well as the speed/smoothness of their technique after a certain amount of training. The likely reasons are the nerve/muscles are better trained with repeated exercise (better proprioception), the fast twitch muscles become better at what they are being asked to do, and a modest increase in muscle mass also takes place (less hypertrophy than in adults though).

**Equipment needed?-** Actually, you don't have to buy anything at first. Resistance exercises can start with your own body weight. Pull-ups on a bar at the city park, push ups and stomach rocks on the floor are a great start. Remember the goal is 3 sets of 15 repetitions for each exercise- slowly and smoothly. A thera-band might be the first thing to buy. Next an exercise ball and a light weight medicine ball (4-6 pounds for most elementary school kids, 8-12 pounds for most high school kids) will increase the number of exercises dramatically. Lastly, free weights can be purchased. Light weights, high repetitions. Research with books on what exercises are best. I would recommend waiting 4-6 months into your child's strength training before purchasing free weights. This will show commitment by the young athlete by accomplishing skills with a theraband, exercise ball and medicine ball, as well as increased CORE training and stability with exercises done safely and effectively without weights. Once the child shows commitment, CORE strength, and continued interest, free weights may be a nice addition.

**Don't forget about aerobic exercise-**

Lastly, aerobic exercise is important as well. Cardiac health as well as keeping a healthy body weight (Body mass index BMI) is best accomplished with good nutrition and exercise. Running, swimming, and bicycling are three examples. At least twenty minutes of intense aerobic exercise per day is recommended.

## Growth and Development During Adolescence:

To understand when growth is abnormal- it is best to first understand what is normal.

Most girls start puberty around eight to ten years old. Most boys start around ten to twelve years old. Puberty is classified in five stages called “Tanner Staging”. Tanner 1 is from infancy to the beginning of puberty. Tanner 2-4 occurs during adolescence and Tanner 5 is adulthood. So Tanner 2 is important because it is the proof that puberty has begun. Tanner 4 is also important as it is typically the time of most growth as well as the start of menses (the period) in females.

### Tanner Staging- Development

	<u>Boys</u>	<u>Girls</u>
1	No pubertal development	No development
2	Scrotum enlargens around age 10-13	Breast bud develops around age 8-11 (late if after 14 yrs)
3	Increased growth and sexual development	
4	Increased muscle mass, stature around age 14-17	Period (menses) starts (late if after 16 yrs) and increased stature, “female appearing hips”
5	Final adult sexual maturation and height	

Normal growth in adolescence is two inches per year with one or two growth spurts occurring before adulthood; a growth spurt is an increase of 4 inches or more in one year.

A child’s final height can be predicted using several techniques. The first is looking at his or her growth curve. Clinicians can make an educated guess of final height by observing the child’s current height velocity compared to others their same age.

Added information can assist the clinician in predicted height. Parental adult height along with when they started puberty and had a growth spurt can be used to come up with a mean parental height (MPH).

An x-ray of the hand (a bone age) can be used to determine how the child’s development is progressing compared to others their age. This is an interesting

and fairly important part of a growth work up. If a twelve year old girl has not started puberty (remains a Tanner 1) and is short on the growth curve and the parents are both average height and they began puberty at 10 (mom) and 12 (dad)- a bone age is a great first step in evaluating the child's growth. While the chronological age of the girl may be 12, the bone age- or development of the body- may be delayed. A book is used to compare the x-ray of the patient's hand and its growth plates to that of other girls the same age. It is extremely accurate and needs to be the first step in any height or puberty and development work up in an adolescent boy or girl.



Bone age film of the left hand, the “cracks” in the bones are growth plates and each bone is evaluated to determine the age of the child's bones- which may or may not turn out to be the same as the patient's chronologic age

Finally, there are several lab tests that can be accomplished including growth hormone, thyroid levels, chromosomes (to look for Turner syndrome in short stature girls), and growth stimulation tests.

### **Tests for Growth and Development**

**Physical exam: Growth Curve of height and weight  
and Tanner staging**

**MPH- (mean parental height) history of parents growth  
and their adult height**

**Bone age- x-ray of hand looking at growth plates**

Lab tests- thyroid, chromosomes, growth hormone

Stimulation tests- for growth hormone activity

MRI head- to rule out pituitary abnormality, not necessary in every case

While many families are satisfied with whatever height their child is- others are interested in having their children achieve some minimal height before their growth plates close. Other families are interested in their children achieving an increased size for sport. Medical as well as ethical considerations must be made before treatment is deemed safe as well as helpful.

**Delay of growth (that which is less than 3% on the growth curve, or less than two inches of growth per year), a girl who has not started breast development by 14 or menses by 16 years old, or a child that does not appear he or she will make it to their MPH (mean parental height) should be worked up.**

Treatments include testosterone in delayed boys, thyroid hormone in thyroid deficient boys or girls, and growth hormone in the select few who are truly growth hormone deficient. Testosterone and thyroid hormone are inexpensive, safe, and helpful to those who qualify. Growth hormone is extremely expensive (\$30,000 or more per year for 5-7 years), has potential side effects, and is only helpful if truly growth hormone deficient.

### **Treatment Possibilities for Growth Delay**

Observation- recheck bone age in 6-12 months

Testosterone for boys who are delayed but have enough GH

Growth Hormone- for those that are truly GH deficient

Look at diet, chronic disease (such as asthma, celiac disease and other gastrointestinal problems), medications (repeated oral steroids), and environment (neglect, extreme stress)

Children that are progressing too quickly either in height or sexual development should also have a work up. Although they may be “tall” compared to their similar aged friends, they are likely to stop maturing too quickly as well as end up stopping their growth before they should. This will result in the bone age being advanced and growth plates closing before they should. While a precocious growing child may be seen by parents as a strong, mature child- if not slowed- it can result in a shorter than desired adult.

Parents and patients should not be “scared” of a growth evaluation. Not all short kids need a growth work up. Looking at the family history and growth curves are important. If your doctor is interested in a growth workup though, realize that there are treatments available- so have an open mind! Don’t say, “Mother nature meant it this way.” You wouldn’t say that if your child had diabetes, high blood pressure, or pneumonia!

Growth hormone deficiency affects the heart, immune system, and overall life expectancy- not just the height. Turner syndrome affects girl’s height but also their reproductive organs, their heart, and their overall development. Therefore growth and development should not just be “brushed off” as looking for a short or tall person- it should be a part of the overall care of a young athlete.

## Nutrition in the Young Athlete

Let's cover some basics first. Athletes are NOT normal people. They need MORE calories than a person the same age who goes to school and then home to play video games. Video games use up time; not calories!

Calories are made up of carbohydrates, protein, and fat. Everybody needs fat; even athletes. The percentage of each is a debate. People that like the "Zone" or "Atkins" believe you should have more protein while other diets suggest more carbs. There is probably no one correct answer and every expert has a reason why theirs is best.

**Protein** is used for building blocks for new growth as well as making enzymes, immune system use, and other long term health needs.

**Fat** is used as a secondary energy when carbohydrates are running low. It is also an important resource for the brain, connective tissues, and for storing fat soluble vitamins.

**Carbohydrates** are used for fast energy and are probably most important during the actual activity. Carbs are stored as glycogen to be used during the first 90 minutes of exercise. After that, fat is needed for further energy if carbs are not replenished.

Candy bars and soft drinks are difficult sugars to break down and although often give a quick burst of energy, also have a major let down and lack of important nutrients after the first hour of exercise.

For conversation sake, many sports nutritionists would recommend 50-65% carbohydrates, 15-25% protein, and 25-35% fats. If your expert says something different, that is ok... keep reading anyway!

Before practice, an athlete should prepare for workout. **Carbohydrates are the food stuffs that are broken down the quickest.** An apple, fruit juice, or bagel would be examples of easily digested, quickly usable carbs. Peanut butter offers both some carbs and some protein- a great combination to put on a bagel!

Depending on the exercise decides the need for a snack mid way through. Aerobic exercise is constant- such as long distance running, swimming, or the forward on a soccer team. Anaerobic exercise is not constant- such as gymnastics, or the center tackle on the football team. Aerobic exercise uses up energy more quickly. That is why marathon runners are offered orange slices and juice every few miles and

anaerobic exercise like football players can play an entire game only needing water or a sports drink.

After a workout, the body is craving carbohydrates from the depletion during exercise. If you are going to have something not healthy this would be the time. The snack should not be excessive though- not for about thirty to sixty minutes.

### **The science:**

During exercise, blood goes to the area that is hungry for oxygen. You will notice your biceps fill with blood during curls. Where is this increased blood flow from? Well, during exercise, the brain, kidneys, and heart keep their needed blood flow and the muscles in need “steals” the blood from less vital organs such as the stomach and intestines. During this time, the stomach and intestines receive less blood so the muscles and heart (coronary blood vessels) can get more. It takes time after exercise for the blood flow to regulate itself back to normal. Cramps, stomach aches, and even nausea may result from a large meal immediately after exercise since the stomach and intestines are unprepared to work.

Still, it is a good idea to get some carbs in quickly such as a sports drink, some fruit, or even a small milkshake.

**How about dinner after competition?** This is a good time for protein- those building blocks for future growth of muscle, bone, and needs of metabolism. Athletes need carbohydrates right before, during, and right after exercise and then protein for the days after. Meals not directly around exercise are a good time for protein and fat.

**So what about fat?** It is actually important too- it is used for reserve energy if carbohydrates are used up. The brain is made of mostly water and fat. Fat is also used to break down and store fat soluble vitamins.

**A teenager needs about 25 calories per pound per day** (50-55 calories/kg/day). A teenage athlete needs more to build muscle and keep bones from stress fractures. For a 100 pound athlete that would be at least 2000 calories per day.

**Basal Rate:** Athletes weight in pounds divided by 2.2= kilograms  
If female multiply by 0.8 to see hourly basal rate  
If male multiply by 1.0 to see hourly basal rate  
Multiply this number by 24 to see daily basal rate

This is the fewest calories necessary just to live, sleep, and eat

If you are involved in moderate exercise add another 0.8 times your basal rate and in heavy exercise, double your basal rate.



**Here is an example of the fewest calories needed for a premier level male soccer player who weighs 100 pounds.**

**A:** 100 pounds divided by 2.2 = 45 kilograms

- 45 kg times 24 hours = 1080 calories needed for daily basal rate
- 1080 times 2 for heavy exercise = 2160 total calories needed to play soccer at a high level

Therefore, this athlete needs 1080 calories for daily living and ANOTHER 1080 calories to play soccer to ensure that growth is normal, and the chance of injury is reduced

Fewest Acceptable Total daily calories = 2160 calories

**B:** The other calculation takes weight (100 pounds) X 25 calories per pound per day= 2500 calories needed per day

**The results:** A growing athlete weighing 100 pounds therefore, (during puberty) that does not get between 2100-2500 calories a day risks shorter than normal growth potential, a higher risk of stress fracture and muscle injury, a hungry and easily distracted mind, and a less than full potential athlete.

It's like a race car with 87 octane fuel which knocks and sputters... it would run better, smoother, and faster with 100 octane fuel!

**And how about vitamin and mineral supplements?**

Supplements are probably unnecessary in most healthy children who are offered a good diet. If you were to mention a couple though- athletes will benefit from a 1000 mg calcium supplement with Vitamin D between 800-4000 international units if they don't get it during their normal diet. \*Check with your doctor as dose recommendations do change.

Calcium and Vitamin D are important for bone health. Because vitamin D helps with calcium absorption, it's best to take them together. Tums (calcium carbonate) is not a good choice as it has a poorly absorbed calcium and no vitamin D. Too much calcium in any form can result in kidney stones, as well as potential calcium deposits causing vascular and heart problems, so more is not necessarily better. Athletes with kidney stones, hyperparathyroidism, or urine abnormalities should check with their health care provider before starting a calcium or vitamin D supplement. And every athlete avoiding soft drinks high in Phosphorus (dark colored regular and diet drinks which might steal calcium from your body) is best, replacing them with milk, fruit juices, and water.

Vitamin D has become a "hot topic", not only for the proven improved bone health, but also as a potential benefit to the brain, and potential decrease in the risk of some cancers, and the potential decrease of chronic pain and some

forms of depression. It is a vitamin many health care providers are checking in their patients (25-OH Vitamin D), and supplementing when found low (prescriptions up to fifty thousand IU per week for several months in some cases). We get vitamin D from food, such as milk and fish, and also from sunlight. You can't get too much vitamin D from the sun (but you can get a sunburn and skin cancer so 10 minutes or so of sunlight without skin protection is probably enough). People living north of 37 degrees latitude (Tulsa, OK) likely don't get enough vitamin D from sun during the winter season (what may cause Seasonal Affective Disorder (SAD) in some people). Too much vitamin D in foods or supplements can cause diarrhea and like too much calcium, may increase the risk of kidney stones and calcium deposits in the vascular and cardiac system. Some health care providers believe D2 is good while many believe D3 is superior.

There is a lot of media attention (and salespeople) interested in selling you other vitamins. Hot topics include iron for runners, fish oil for the heart, probiotics for the intestines, and mangosteen for the immune system. While none are likely dangerous, they are also probably unnecessary (and expensive) if you already have a good diet! Research is constantly being done to prove effectiveness or danger with too little or too much of a vitamin or mineral. It can be difficult for even your health care provider to keep up!

Bottom line- athletes, even more so than non-athletes, need food! And Vitamins DO NOT contain Calories! Eating right is most important, adding supplements might be considered in those that can't achieve optimal nutrition with eating.

The constant media attention on eating right, fad diets, and not eating so much is directed towards the non-athlete. And while the American public indeed has a greater percentage of unhealthy, obese people at risk for diabetes II, hypertension, and high cholesterol--- the great majority of young athletes need healthy calories for continued growth and muscle/bone strength. The media also promotes tiny, fatless models that may mislead young athletes in believing the less you weigh the better. On the contrary, calories help athletes achieve stronger bones and increased muscle- all which must weigh something!

### RULE OF THUMB:

There is an increase of osteoporosis in middle age women. Had a woman increased her calcium intake with Vitamin D between childhood and age 23 years- she may have been more protected. The most important time for Calcium and Vitamin D intake is before osteoporosis begins- not after!

Swimming and non-impact sports increase the risk of osteoporosis. The most AT RISK athlete, therefore, is a female competitive swimmer.

## **Eating, A Race Car Analogy:**

Nutrition is such an important factor in the success of a high level athlete- and often one that is not discussed- at all! This book is not intended to be a complete guide for any one area- but here is just a little more on eating.

Let's start with an analogy. A race car may have the most horse power (speed), the best driver (mind, attitude, dedication), the strongest body frame (strength), the most expensive tires (equipment, sponsorship), and the best pit crew (coaches, parents, team mates)- and still not make it off the starting line if someone forgot to add the right fuel!

And not just any fuel, like what your parents put in their Sports Utility vehicle (87 or 89 octane)... a race car requires fuel that allows fast speed, long races, and high competition (100+ octane!). This fuel is more expensive and yes, a race car needs LOTS of it- depending on the race- the car may need several pit stops for refueling. Why? Because it burns the fuel so quickly when the driver is constantly going faster and faster and demanding more and more. Athletes are like race cars. They demand energy for practice and competition and then require more energy for re-building and gaining strength. An athlete needs a healthy meal before competition, hydration and possible healthy snacks during competition, and then a healthy meal for rebuilding and strengthening after competition.

Athletes that eat poorly (or not enough) can not perform at their peak, can not rebuild after a long workout, and can not gain endurance and muscle. If an athlete is doing well while eating poorly- they would even be faster, stronger, and healthier if they ate better. Just like a car- it can run on 87 octane- but runs smoother, faster, and more powerfully on 92 or 100 octane.

Race cars use up almost all their fuel during the race (like an athlete during practice) and need to be refueled often. And a car that doesn't get enough energy with gas- or an athlete that doesn't get enough energy with food- will sputter to a stop while the competition passes them by. Race cars that get too little gas (not enough calories) or bad gas (fast food, junk food, soda) ultimately have problems with winning the race and have problems with the car (an athlete will get weak bones, less muscle, trouble concentrating)

Athletes sometimes become overly concerned with eating because they see their non athletic friends gaining unhealthy weight. Kids that are sedentary- playing video games or watching TV are more like SUV than race cars. SUVs travel more slowly (not as much exercise), and therefore use fuel but not as quickly. The left over fuel becomes excess weight in an SUV (person not exercising), while any excess fuel in a race car is helpful to beat its competition in the final laps of the race (an athlete uses excess calories to build stronger bones and more muscle).

Although nothing in humans is as simple as this analogy to cars- it is similar and essential for young athletes to understand.

## **Water versus Sports Drink**

The short answer is WATER!

But as in most things, it is more complicated than just an easy answer. Once you are thirsty, you are already at least 5% dehydrated. Don't let your athletes get to this point! It will slow them down, wear them out, and possibly be life-threatening.

Even NFL athletes with athletic trainers at their side have died from the summer heat- all they needed was more water! Thirty to sixty minutes before practice, drink several 8 ounces glasses of water...How much is enough? Until you urinate before the competition and the color is light yellow and odorless- that is the best test that you are hydrated. You asked! No matter what... let your athletes drink! Make it convenient so practice is not interrupted and it is not used for an excuse from something the athlete may wish to avoid.

So what about sports drinks. These drinks have electrolytes and sugar. It will increase carbohydrates lost during heavy aerobic exercise while still replenishing fluids. It also will make the gut work slightly harder processing that extra stuff and may even cause, in some athletes, nausea, stomach ache, or diarrhea- not the best during a competition! During a practice or competition lasting one hour, I recommend drinking water. If the competition lasts over an hour- or you have several games the same day- drink water the first hour and then switch to a sports drink to help replenish sugars and electrolytes. Regardless of the choice of drink- approximately 6-8 ounces every ten to twenty minutes is best- less for anaerobic sports like gymnastics and more during high sweat activities such as a soccer game in the summer heat. And a sports drink to replenish carbohydrates and fluid at the end of any length workout is fine.

What about supplement drinks and power, energy drinks? Drinks with extra protein or extra carbohydrates may or may not be beneficial depending on your goals such as gaining weight, increasing endurance, etc.

**Drinks with high amounts of caffeine, taurine, boost supplements, or hormones are never appropriate and may be dangerous, including increased heart rates, diuretic effects (dehydration), and other potentially unhealthy risks. There are rare reports of death associated with energy drinks possibly from ingesting more than the recommended amount, consuming with alcohol, or while dehydrated.** Coaches and parents need to be responsible in educating young athletes on not only what is ethical in sport, but also what is safe. Energy drinks ARE NOT SAFE!

## **What about creatine?**

Creatine is normally found in meat such as steak. Its function is to build muscle. Increased intake of this natural supplement will enhance an athlete's strength and conditioning.

Some high school football and wrestling coaches request that their athletes take creatine. This is a risky addition to a team's work out without knowledge of each athlete's medical history.

There have been several case reports of decreased kidney function after creatine. Most reports explain creatine injured already imperfect kidneys.

While normal kidneys that are well hydrated are unlikely to be altered with creatine, there is still unknown risk to growing kidney cells in an adolescent. Thus, athletes under eighteen years old, those with a history of kidney disease, or a family history of kidney disease should not take creatine.

### **Other supplements:**

Androgenic steroids, growth hormone, DHEA, and other supplements are hot topics in certain athlete circles. All are prohibited by the IOC banned drug policy. All are unethical for competition and have side effects which could be unsafe for the athlete. The liver (steroids), brain (steroids), heart (growth hormone), and kidneys can be negatively impacted by ingesting even "natural" supplements if it can not be efficiently used or removed.

And some supplements, especially those "promising" one thing or another- are either a money stealing hoax, or an illegal substance.

**Try eating, working out, and not missing practice!**

## Female Athlete Triad

Just as in previous chapters, this subject could take an entire book for complete explanation, history, and treatment. Instead of a comprehensive view of this complex, difficult to treat, and often difficult for the family, athlete, or coach to even admit- the female athlete triad will only be briefly explained in this book. More information can be found in various sources such as medical journals, reputable internet sites, and the health section of your neighborhood bookstore.

The Female Athlete Triad has three mandatory defining factors.

1. Late or lost menstrual cycle
2. Weak bones (osteopenia → and if not treated → osteoporosis)
3. Poor nutrition (commonly an eating disorder but not necessarily anorexia)

### Here are some “need-to-know” definitions:

**Menses-** typically occurs within a year of the time the patient’s mother had her first menstrual period, and normally about 6-12 months after the beginning of breast development

**Late menses-** typically menses is considered late if it hasn’t begun by age 16 (it will not occur without approx. 18% body fat, therefore very lean athletes may not begin by 16)

**Late thelarche (puberty beginning)-**no breast development by 14 years of age.

**Osteopenia-** weak bone, increasingly common in adolescent women

**Osteomalacia-** weak bone due to lack of calcium or vitamin D

**Osteoporosis-** porous, weak bones typically describing a woman after menopause, but could be found in men and in younger women in some situations

**Anorexia nervosa-** an inappropriate self-image that results in decreased calorie intake and eventual sub-optimal nutrition for the body’s organs to properly function

**Bulimia-** eating and purging to keep one’s weight stable, may use laxatives

**Eating disorder-** any dysfunctional intake of calories due to inappropriate self-image, and ultimately may limit the normal functioning of the body’s organs. Can be, but not limited to, anorexia nervosa and bulimia.

**Disordered eating-** some would add this term as poor eating habits due to work-out schedule, travel, ability to eat before competition that could, with time, result in harm to athlete’s body. It occurs because of outside demands rather than altered self-image. Common in athletes and can be equally dangerous.

### Sports most at risk for Female Athlete Triad

Gymnastics

Dance

Ice Skating

Cheerleading

Long Distance Running

### Most likely sports for eating disorders in males

Long distance running

Equestrian

Wrestling

Ice Skating

## **Warning Signs of an Eating Disorder**

1. Suddenly eating “only healthy foods” or salads
2. Excessive new interest or reading about fad diets or exercise plans
3. Asking parents about self image, “How do I look”, “Am I fat”, “Is my best friend fat?”
4. Excessive loss of weight, loss of interest in family activities, wearing baggy clothing, suppressed mood, decreased energy level or change in sleep habit

## **Stereotype personality of a person with an eating disorder**

Type “A”  
Good grades  
People pleaser  
Hard worker, hard on themselves

As in most mental health disorders, eating disorders are often the hardest diagnosis to convince the family and the athlete that something must be done. Denial, fear, and family privacy all intertwine to make it extremely difficult for physicians, nutritionists, and other health professionals to become involved. In the beginning- when treatment may be most helpful and least difficult- the family may be most resistant to help. Often the illness and problems resulting from the illness become so severe before the patient and/or family admits there is a problem- that hospitalization and intensive inpatient treatment must occur- or tragedy results.

Indeed, many athletes have some form of eating disorder that never becomes completely obvious, completely life threatening, or completely stereotypical (some experts say a greater percentage of athletes in some sports do have some sort of “disordered eating” than don’t, and many have an eating disorder as well)

The reason for the great number of eating disorders reported by some experts is as follows:

1. There are indeed eating disorders that are unhealthy but are not specifically anorexia nervosa or bulimia, they are called anorexia not otherwise specified or eating disorder, not otherwise specified.

Depending on the criteria, expertise, and how liberal the expert has for the definition of an eating disorder- one athlete may be considered to have simply an “unhealthy eating habit” while another expert may consider the same athlete “at risk” and still a third may call the same athlete with a defined eating disorder.

2. Since health experts began using Body Mass Index (BMI), along with other simple office tests- rather than simply a growth curve- low body weight is easier

to detect (as is the opposite- too large of body mass which has an increased risk of diabetes, heart disease, etc.)

3. Increased sport (and overall life) expectations by coaches, peers, and parents has increased the hours of practice and competition making it difficult to have the time for “healthy meals” as well as an increased self awareness of body image by athletes noticing team mates and comparing themselves to professionals and athletes and models in the media.

**Some physical exam signs of a possible eating disorder**

Dry skin, dry hair, these can also be found in thyroid disease	
Increased thin hair on arms and legs	Loss of having periods
Slower than normal heart rate	Excessive loss of weight
Stress fractures (typically more than one)	

Children with the best outcomes are those that get medical, psychological, and nutrition help along with family, friends, and coach support- a complex combination that is often difficult to obtain. If even one of the above “doesn’t believe there is a problem”, “refuses to have further evaluation”, or “always has an excuse for why not to get the child help”- the support structure can collapse- and the child’s treatment may be further delayed, sometimes until an emergency inpatient hospitalization becomes necessary.

Rarely-if ever- the child realizes there is a problem and asks for help. **When looking in the mirror- the child simply does not see themselves losing weight.** Instead they continue to see themselves not looking “right”- and continuing to need to “look thinner”, “smaller”, or “better”.

The important concept for this book is to acknowledge the often deceptive nature of athletes with an eating disorder, the typical denial of parents and coaches taking care of athletes with an eating disorder, and the more common than diagnosed frequency of athletes with eating disorders. Education, honest dialogue, and early treatment are the best strategies to avoid this problem from becoming a life threatening situation.

**Drugs potentially used by the patient to “assist” themselves with an Eating Disorder**

Caffeine	Pseudofed
Laxatives	Diuretics
Emetics (syrup of ipecac)	Cocaine
Methamphetamine (ADD medication).	



### **What is the treatment for Eating Disorders**

Mental Health 100% necessary- 5 self image alteration- psychologist and/or psychiatrist knowledgeable in this topic

Support by family, coach, team-mates- 5

Medication and sometimes inpatient hospitalization for stabilization of weight- 5 physician interested and knowledgeable about eating disorders

Diet alteration- 5 nutritionist absolutely necessary

If available, an eating disorder team where each specialist can discuss the case together

\*This is sometimes difficult for involved people to comprehend because it is a slow, deceptive problem, many times held in secrecy by the patient or the patient may not even realize it is happening

### **Why is anorexia life threatening?**

Change in electrolytes such as potassium and glucose

Change in heart rate and cardiac output (decreased heart rate)

Change in organ functions- examples include thyroid, ovaries, brain

## The Finish Line



## **Final Thoughts:**

As you have worked your way from “*the new parent on the team*” to “*the mom in charge of oranges and water at the end of the game*” to finally “*team manager in charge of jerseys, travel arrangements, and collecting team dues*”- you now, possibly, have also become the authority on sport’s health care to the rest of the parents!

Certainly everything can not be covered in a book like this; however it hopefully offers good suggestions to ensure your child is receiving the best- and most sports friendly care- offered.

**There are very few rules in medicine**- you hopefully also have learned there is often more than one correct answer (and sometimes a second opinion is helpful to investigate various treatment strategies)- and the family must decide what is best for their current situation. A finger fracture for one child may be enough to not practice until it is healed- while another athlete may tape it and play in the next game. So- here are some reminders on the few rules that seem to hold true:

1. Children don’t normally limp, if your child is limping- find out why.
2. The sooner you get a diagnosis- often the less time treatment takes, avoidance rarely makes the cause for pain to disappear!
3. For injuries- physical therapy is often the correct treatment- and worth the time and money to prevent a future injury and ongoing pain.
4. Nutrition (calories) is as important as equipment (shoes/helmet), medication (such as albuterol for asthma), and coaching. Don’t forget the water and food, especially for growing athletes!
5. Concussion can be life threatening. If one is suspected, remove the athlete from sport until a concussion trained medical provider can offer return to play recommendations.
6. If someone (coach, health care provider, family member, neighbor, vitamin/supplement salesman) tells you there is only one way to handle a problem- investigate- often there is another option.
7. Most doctors are good but not all are interested in sports care for kids- finding one that is sports interested may increase the accuracy of the diagnosis, the speed of the treatment, and the education for the coach, athlete, and parent to avoid a future occurrence. A sports knowledgeable physician won’t remove your child from a sport unless necessary- and if it is necessary (concussion, splenic enlargement due to mononucleosis, etc.)- it is likely more important to comply with the doctor’s warning

than participating in any game or competition- even Finals, the World Series, or Nationals.

8. Athletes, and occasionally parents and coaches, fail to offer the whole story- with fears that the medical community will prohibit participation in sport- what the child loves the most. Finding a health care provider that understands the athlete's commitment and love for the child's sport as well as the knowledge to know what is safe for continued participation, and what could be too much risk- even for the premier athlete- is essential for everyone's trust, satisfaction, and safety.

While not everything can be addressed in this book- I hope it has offered some suggestions to help you and your athlete succeed and stay safe in competitive sport.

*This book is dedicated to young athletes  
who watch in awe the Olympians of today,  
who dedicate their life practicing the sport they love,  
and who dream of becoming the next super star athlete...  
who the next young generation will watch in awe.*

**This text is NOT an authoritative medical resource. It is intended to offer accurate information for parents and coaches to better understand several sports medicine topics and increase their knowledge to better communicate with their health care provider. The information is NOT exhaustive and may change as new information is learned or researched.**

