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http://videolink.pennmedicine.org/videos/the-ankle-sprain-that-doesn-t-heal via PennMedicine.org

TRANSCRIPT:

My name is Daniel Farber. I'm assistant professor of clinical orthopedics at the University of Pennsylvania Perelman School of Medicine, director of the foot and ankle fellowship there, as well as the foot and ankle research. Today, however, we'll be talking about a more clinical topic. We'll be talking about the ankle sprain that doesn't heal.

First of all, we're going to review some of the ankle anatomy and talk about ankle sprain mechanisms, grading and treatment of ankle sprains, and, finally, we're going to really focus on going through some case scenarios od ankle sprains that don't heal and what the pathology behind that is. Then, we'll briefly review what we've gone over.

First, we'll just talk about some anatomy and I'll point out some important elements around the ankle, and especially the lateral ankle, which is where most people have their injuries. If we look at the side ligaments of the ankle, there's the primary ankle ligament, is the anterior talofibular ligament here, and the calcaneofibular ligament that's right here. The anterior talofibular ligament, what's often referred to as the ATFL, is the most commonly injured ligament. There's also the interosseus, bifurcate ligaments, and cervical ligaments, which mostly correspond to what's called the subtalar region, which is actually the joint below the ankle joint. You don't have to pay too much attention to those in a clinical practice, but they're important to know in terms of the overall anatomy of the ankle.

On the medial side, you have the deltoid ligament, which is in four parts, part superficial and part deep. This is a very strong ligament and it's very rarely injured but sometimes you can have issues here. We're not going to focus too much on that. Finally, there's a spring ligament. That's this ligament down here that really provides support for the arch of the foot, more so than it does in your average ankle injury.

Then we'll also talk about the syndesmosis. The syndesmosis is this tough, fibrous connection between the fibula and the tibia. This is where you have a high ankle sprain, is when you have disruption of the syndesmosis. There's some very strong ligaments down here at the front outside part of the ankle that can become injured, as well, and is part of the differential when you're looking at an ankle injury.

This other diagram right here is the back of the ankle where you see the posterior supporting ligaments of the syndesmosis.

Finally, there are a number of tendons on both the medial and lateral sides of the ankle. Most importantly are the posterior tibialis tendon here, which is one of the tendons that helps to support your arch, as well as stabilize the ankle on the inside. Then, on the lateral side, you have the peroneal tendons. These can be a source of pain in ankle sprains, and it's very important to be aware of those, as well as some of the very lateral extensor ligaments like the peroneus tertius.

All these ligaments that we've talked about, as well as the tendon structures, have the potential for injury. As we talked about, the anterior talofibular ligament, or ATFL, is the most common, but the

calcaneofibular ligament is also very common, which is that ligament on the side of the ankle if we go back to our diagram back here. It's this ligament right here, is what's called the calcaneofibular ligament, running from the fibula to the calcaneus, obviously.

If we go back to where we were, deltoid ligaments are less common, as we talked about. Syndesmotic injuries are a bit more rare in terms of rare syndesmotic injuries. They take a lot more trauma to happen, but you will see sometimes some high ankle sprains, especially in athletes, and it's an important diagnosis to be aware of. We'll talk about that in more detail.

Ankle sprains can happen through multiple mechanisms. Most commonly, it's an inversion injury. If we watch this tennis player and see his ankle roll and the whole foot inverts, you know that something's got to tear or be injured when you get that severe a force to the ankle.

There's a number of different ways to grade ankle sprains. There's a couple different systems, there's the anatomic system and the AMA system. I won't go into great details, but it kind of gives you a sense of how bad the injury is.

The clinical system is the one that's probably most commonly used. That really just goes from mild, moderate, to severe, mild sprains being just the minor injuries, so minimal functional loss. They don't really limp afterwards, they have a little bit of swelling or point tenderness around the area of injury, and, if they twist the ankle the same way that they injured it, it will hurt, but they can weight-bear on this, they can get around. These are the mild sprains that really last just a handful of days and then people recover.

The moderate sprains are the more severe ones. These are the ones that may drive people to the emergency department. They'll have moderate functional loss, they may be unable to push off on this foot, they'll limp when they walk, they'll have a lot of swelling in that localized area and point tenderness. They can still get around and weight-bear for the most part.

Severe sprains are the ones that really have a lot of tenderness and swelling. They don't want to weight-bear so they'll use crutches, they'll ask for the splint or the cast or the boot or whatever to try to protect this.

A couple different ways to evaluate these injuries. First is just visual inspection, just simply look at the ankle. What's very helpful in orthopedics is that you have two ankles to look at most of the time and compare side to side, look for where the areas of swelling are, where the areas of bruising are, and that can give you a sense of the injury. Remember that bruising tends to migrate down into the foot and around the toes, and so you can sometimes see quite a bit of bruising around the toes or the very lateral aspect of the foot. That doesn't mean that the injury is in that area.

Palpate. Very important to palpate both the fibula, looking for a fracture, as well as along the ligament structures, as well as along the base of the fifth metatarsal.

An anterior drawer test can be very helpful either very early in the injury process or later in the injury

process to assess if there's instability of the ankle. In this image right here, you can see the evaluators hand, and that's pulling forward on the ankle. This hand is stabilizing the foot. You're looking to see how much the ankle travels forward. Sometimes, you'll even see a little dimple sign right there where the traction on the join causes a little suction. That's a positive anterior drawer test, showing that there is instability of the ankle.

The other thing to do is to test the ankle with varus, as well as valgus, stress. Varus stress means torquing it in inversion and seeing if the ankle is unstable compared to the other side.

This is a textbook image from an anterior drawer test. You see here that what we call sort of a sulcus sign or a suction sign where there's this dimple here when you stress the ankle.

This is the Ottawa rules that kind of tells you when to take an X-ray. In orthopedics, and certainly in foot and ankle orthopedics, most of the time we're seeing these patients, they're going to get an X-ray because they've already been referred through other folks, but it's always helpful to be aware of the Ottawa rules in terms of when you should get an X-ray in an acute injury.

This is an X-ray image. Again, textbook image showing you the instability of the ankle. This is an anterior drawer test under X-ray. You clearly can see where the ankle is ... Underneath the ankle mortise here and here, you have this incongruency of where the joint is. That's a positive test, obviously, of about a centimeter plus of anterior translation.

This is a talar tilt test. What you're looking at is whether or not these lines are fairly parallel. What you see here on the bottom image is how this ankle opens up when you put stress. That opening up means that this calcaneofibular ligament down here has been compromised and the ankle can shift in much more ... Can shift much more than it normally would be able to if the ligament was intact.
There's a lot of different ways to treat an acute ankle sprain. Obviously, the most important thing, as most everyone knows, is rest, ice, compression, and immobilization, or the RICE type protocol. You can immobilize these in a lot of different types of devices. This is a lace-up type ankle brace or a hinge-stirrup type brace. This is an Aircast. This is commonly used in the emergency department for acute injuries. Most patients don't like this after a day or two because it doesn't really fit very well in a shoe and it often causes them a bit of discomfort because of the rigid plastic sides.

Also, if it's a more severe injury, sometimes a CAM boot or even a cast can be helpful to get things to quiet down in the early timeframe.

You want to let them advance their weight-bearing as soon as they feel comfortable so that they can start rehabbing this and recovering from the injury.

Sometimes you do all the right things, you treat them with rest, ice, compression, and elevation, you get them moving, you rehab them, you put them through a course of therapy even, and they still don't get better. That's really what we want to talk about today, is what are the things that could be happening that explain why an ankle sprain that should get better is not improving.

The way I put this together was to have a couple of different scenarios that go over some of these potential injuries. Scenario #1 is a 20-year-old female. She injured her ankle snowboarding about six weeks ago. She was seen by the ski patrol on the hill, told that she just had a sprain. She used a lace-up ankle brace for a couple of weeks but really continues to have a lot of pain, especially along the anterolateral aspect of the ankle, and especially when the ankle is really everted and rolled out to the side.

Here's a potential scenario where the snowboarder gets injured. You can see her coming down the hill in her best form, coming off a little jump, and, boom, she hits the ground. The foot tends to dorsiflex and evert and creates this injury that you see here. What you can see subtly on the X-ray is this little abnormality here along the lateral aspect of the talus. This is commonly referred to as a snowboarder's fracture. On a CT scan, it becomes much more clear that, as the calcaneus comes up, it kind of hits against the fibula, it nutcrackers this little fragment here and breaks it off. This is part of the joint, of the subtalar joint, so it's an important fragment.

It's a dorsiflexion eversion mechanism. That nutcracker effect happens on the talus. This can be very easily missed because, on regular ankle films, it's not always as clear as the X-ray that I showed you. A CT scan will show it but you have to have the suspicion and the knowledge that this might be an injury in order to even pursue a CT scan.

The importance of this injury is that it's much better to treat this early surgically. If it's a really small fragment, you can sometimes treat this with nonoperative care, but a lot of times, especially with athletic patients who are very active, if this is a small fragment or it's broken into a lot of little pieces, they do much better with early excision. If it's a significant fragment, they'll do better with fixing this.

This is a patient of mine from a couple of years ago. You can see this is a pretty large articular surface fragment that's fractured. Then, you'll see in this image here, the peroneal tendons, running right in this area. This is the lateral ankle here, so this is the front of the ankle. You can see the two little screws here that we used to fix this into place.

The next scenario is a 22-year-old male basketball player. Sprained his ankle about six months ago. He recovered fairly quickly but the ankle has never quite felt right, never 100%, and it bothers him a lot with strenuous activity. The pain is sort of deep in the ankle. Doesn't have any instability, doesn't really have any pain day to day, but, when he's trying to play sports, this is still limiting him.

Here's a potential injury of the ankle. You'll get a little close-up. Look at #50 there as he comes down and rolls his ankle. If you watch a little linger, you get this close-up view. As his foot comes down, you see that rolling mechanism of the ankle. That's a classic eversion ankle sprain injury while playing basketball that we see quite commonly.

His X-rays are pretty normal. You don't see any fractures or any clear abnormalities but, because he's now gone a number of weeks with persistent pain, he got an MRI scan. Here, you see this edema within the bone along the medial talus. This is consistent with an osteochondral injury of the talus. What's happened is basically a shear sort of fracture of the cartilage. Then, you get this fluid that gets pushed

down into the bone. This can be a significant source of pain.

This is often a delayed presentation because, usually, we expect these to get better. I think a lot of minor osteochondral injuries do happen with these injuries but they get better on their own and don't need any additional treatment other than the standard treatment for an ankle sprain. Again, these patients, usually day to day living, this is not a big deal, but it's when they try to ramp up to more strenuous activities that they can't get back there.

The pain is often poorly localized. They kind of just feel it deep in the ankle, and it doesn't always correlate. If they feel the pain on the inside part of the ankle, they can still have the lesion on the outside part of the ankle. It's pretty classic that they're very bad at localizing where the injury is.

X-rays are often negative. Sometimes, you can see some lucency in the talus that suggests there's an injury there but, in more acute injuries, it's often very hard to see, so MRI or CT scan can be very helpful.

In younger patients, a period of casting can be helpful to get this to heal. In older patients, and I'm not talking that old, but really past adolescence, oftentimes surgery is necessary to clean out the area of cartilage injury. We'll often drill into the bone in that area to try to stimulate the body to form some scar cartilage over that region.

This is an arthroscopy. What you can see here is this is a flap of cartilage that's coming up from the normal cartilage surface here. That's part of that cartilage injury. What we've done now is we've basically cleaned out that loose cartilage. Now, we have a stable edge of cartilage. Here is exposed bone. This is a significant injury, where you lose cartilage.

We then drill into the bone and what we want to see is this little bit of bleeding here. That's those good marrow elements that have a lot of stem cells and multi-potential healing cells that can form some scar cartilage over this whole area so that at least that joint has a better gliding surface. That seems to help very well in most patients.

Scenario #3, a 32-year-old female with multiple prior ankle sprains. Her last sprain was about eight months ago. She has persistent pain and swelling, doesn't trust her ankle. She avoids sports. She has several episodes of giving way over the past six months.

You examine her in the office, and this is just the textbook image that we saw earlier. Again, you see this sort of dimple sign. There's clear anterior instability. A patient who continues to be unstable at this stage, with giving-way episodes, they will often benefit at first from a course of physical therapy if they haven't had that already. That's really to focus on proprioception and strengthening of the surrounding musculature to see if that can be adequately ... Sorry, to see if that can adequately restore their sense of stability and allow them to return to activity. These patients often need bracing for more strenuous sporting activity to give them the sense of stability that they need.

If those things fail, then surgery to repair the ligament is often very helpful. This is a diagram of the classic Brostrom-type repair. This is the fibula right here. This is the calcaneofibular ligament, which has

been cut and shortened and repaired. You don't always actually have to repair this. The most important part is repairing what's called the anterior talofibular ligament. That ligament is actually underneath here. This is the extensor retinaculum, which holds down the tendons on the front of the ankle. We incorporate that into the repair for some additional stability. Underneath that is the ligament repair.

That's very successful surgery. People do very well with that and they're able to return to most sporting activities, but it does take about six months before they can go back to real strenuous activity.

Scenario #4 is an 18-year-old football player who twisted his ankle on the turf about a month ago. They did rest, ice, compression, elevation, and told him he'd be better in a couple weeks because it didn't look like that bad a sprain but he continues to have significant pain, pointing to the anterolateral aspect of the ankle. The pain travels up the leg from that point.

X-rays are negative, but an MRI shows this fluid right here in the recess of the syndesmosis. This, as we talked about earlier, is a syndesmotic injury, or your classic high ankle sprain. This is the injury to the syndesmotic ligaments that connect the fibula to the tibia, and so, when the ankle externally rotates, that's what puts stress on these ligaments.

You can diagnose this with what's called a squeeze test where you squeeze the fibula against the tibia proximally in the leg, just below the knee. That should recreate pain at the ankle. People often complain of pain over the tibia where you put your hand or your thumb. That's not a positive test. It has to be pain that they feel down in the ankle.

The X-rays will be negative unless there's severe ligament disruption and instability. That's a different sort of injury.

These take a long time to heal. They need a good bit of bracing for a while and rehab, and mostly time, but they will almost always settle down.

Scenario #5 is a 38-year-old female. She sprained her ankle about nine months ago. She got better for a while but has pain in the anterolateral ankle. No instability. She did some therapy, which didn't help, but she did get a cortisone injection in the ankle and that seemed to give her excellent relief for a period of time.

This scenario, this is really a diagnosis of exclusion until you get to this point. This is an arthroscopic image of the ankle. Patients can develop what's called an anterolateral impingement lesion. What that is is essentially hypertrophic scarring of the lateral ankle ligaments or the capsule. That creates, essentially, an impingement lesion where, when the ankle dorsiflexes and comes up, this excess tissue that you see here in the ankle. Here is the talus and up here is the tibia. When these two bones come together during activities, or even just walking, it pinches all this tissue here and causes pain.

These patients respond very well to excision of this tissue, but oftentimes they'll get better with time or with a local cortisone injection. MRIs are not very helpful. They often don't show this lesion. We're looking at some research to see if ultrasound may be more helpful in finding these lesions, but

sometimes it's simply a diagnosis of exclusion. You've ruled out all the other things, their pain is appropriate and clinically appropriate to this sort of diagnosis, and you offer them an arthroscopy. That will often solve the issue for them.

Scenario six is a 42-year-old female. She turned her ankle stepping off a curb about six weeks ago. They placed her in an air stirrup in the ED but that didn't really help. Her bruising and swelling has resolved but she continues to have a lot of pain over the lateral foot and ankle.

Here are her X-rays. What you'll notice here is some abnormality at the base of the fifth metatarsal. The point here is you always need to check the foot when people have an ankle sprain and turn it because you can sometimes end up with a fracture of the fifth metatarsal. This is indeed a Jones fracture, and it is an area of the bone that sometimes doesn't heal very well, my point being here is that you just need to make sure you examine this as a possible source of their injury.

Treatment is often casting or a CAM boot. Most evulsion-type fractures will heal very readily. The Jones fracture, like we see in this image here, often gives us trouble healing, and so, especially in athletic patients, we'll consider putting a screw down the pike here to get this to heal more quickly. Here is an example of that where you see the screw crossing the fracture line. This, again, helps to get this to heal much more quickly.

Scenario #7 is a 36-year-old female. She suffered an inversion ankle sprain about six months ago. She's done well except she has this nagging posteriolateral ankle pain and swelling and sometimes popping. Worse with activity. She uses a lace-up brace, which makes her feel better for activity, but this is still a significant problem for her.

This is a scenario where we can have some injury to the peroneal tendons. This is an MRI image, axial image. This is the fibula here, tibia is here, and these are the peroneal tendons running behind there. You can see these tendons should be restricted back here. They should be back behind the fibula. This one is subluxating out to the side. In that setting, that instability can cause pain. It can also cause a tear to that tendon.

This is an injury to the superior peroneal retinaculum. It can be simply a shift of the tendons. It can also be a tear in the tendons. Exam is very helpful to look for subluxation. If you have their foot in a plantar flex position and a little bit eversion and you ask them to push against the side of their foot, you'll sometimes feel those tendons shift out of position. MRI or ultrasound can be very helpful for diagnosis.

For a tear, sometimes therapy and bracing is adequate to take care of this. If it doesn't resolve, then surgery to clean out and repair the tendon is helpful. If it's subluxation of the tendons and they really pop out next to the fibula, therapies are often not successful because it doesn't help to restrain the tendon where it needs to be, and surgery to repair that retinaculum is quite helpful.

Scenario #8. A 46-year-old male who sprained his ankle falling on the stairs and has a hyper-plantarflexion injury, as well as inversion. He now complains of pins and needles sensation in the dorsum in the foot, hypersensitivity over the top of the foot, and sometimes the pain will radiate up the anterolateral leg.

In this setting, this is what we often see, is an injury to the superficial peroneal nerve. You can see the branches of the superficial peroneal nerve. They cover the sensation over the entire top of the foot. You can see in this diagram, this whole area is covered by this single nerve. When you turn the ankle, this nerve gets put on tension and you can have a traction injury.

If you look closely at a lot of ankle sprains that you see, in the first few days, and sometimes even a few weeks, they'll have irritation of this nerve, but it often quiets down. It's a little bit more rare that this pain persists for a longer period of time. You can see this on a regular patient just by surface anatomy. You can see the course of that superficial peroneal nerve right in this area. It's a very superficial nerve, very susceptible to injury.

This will get better with time. The most important thing that you can do is to diagnose this properly so you can let patients know that they will get better, it's just going to take time. Most of the time, the nerve recovers, but it can take a number of months. If they're really having a tough time, using some neuroactive-type medications, whether that be Nortriptyline or Gabapentin or Cymbalta or similar things like that to help attenuate the nerve pain, can be helpful.

In summary, an ankle sprain is usually an ankle sprain, but sometimes it's not. If it doesn't get better, you want to further investigate this, both by physical exam, as well as diagnostic tests. It can be any of these diagnoses that we've talked about today, and there's even more, but I won't torture you with all the additional information there.

I want to thank you very much for your attention. It's been an honor to have the opportunity to speak with you. Thank you.