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### Treating the Female Athlete: Sports Medicine Updates for Women, by Women

Narrator:

You're listening to Medical Breakthroughs from Penn Medicine, Advancing Medicine Through Precision Diagnostics and Novel Therapies.

Dr. Caudle:

You're listening to ReachMD, and I'm your host, Dr. Jennifer Caudle, and with me today is Dr. Ellen Casey, Co-Director at Penn Center for the Female Athlete and Assistant Professor of Physical Medicine and Rehabilitation at Penn Medicine. Dr. Casey and I will be discussing issues involving the female athlete. Dr. Casey, welcome to the program.

Dr. Casey:

Thank you so much. It's great to be here.

Dr. Caudle:

Can you start by telling our listeners a little bit about the Penn Center for the Female Athlete? And also, could you discuss a little bit about some of the major differences between males and females, with regards to sports medicine issues?

Dr. Casey:

So, we created the Penn Center for the Female Athlete, mostly to provide a place where women and girls, who are active and participating in physical activity, have a place to come to figure out what, if they have an injury what's going on, or also talk about performance and improvement, not only in their ability in their sports, but also in preventing injury. And so, we are a virtual center, meaning that there's not one specific place at Penn where we see patients and care for patients, but we're actually scattered around the university, in hopes of being convenient for more people. So, I have a Co-Director who is Kate Temme, also a physiatrist and sports-medicine trained, and then, one of our other key colleagues is Brian Sennett who is an orthopedic surgeon and the Chief of the Sports Medicine Division at Penn. And in addition to the three of us, we have gathered a wonderful group of people across disciplines who are interested in treating the same population. So, we have endocrinologists who deal with anything from bone loss or stress fractures, as well as any change in hormones that can affect the body. Gynecologists who help out with sometimes women have irregular menstrual cycles, or trouble getting pregnant, or something related to sports, so we have that covered. We have sports dieticians who are nutritionists but have extra training in treating athletes and active women to help optimize nutrition. There are physical therapists who are very interested in this area and have expertise in getting women back to the activities that they love. And even people like sports psychologists and additional social work and that sort of thing, if people need support as they're either dealing with an injury or recovering. And the reason we've pooled all these types of people together is because we have found, clinically, and there's good research to suggest that women can benefit from comprehensive care. So, they're really the kind of leader of the team when they're seen in our center. And then, we have all of these other providers if necessary who agree to talk amongst each other and make sure we're getting the patients in quickly, if they need to be, and seeing the right provider so that we can treat the whole woman rather than just the injury. And then, one of the reasons that we also wanted to start this center was because there's good research out there to show that men and women have different types of injuries related to sports and their recovery is a little bit different too.

Dr. Caudle:

What are some of the common sports injuries in women and how can they be avoided?

Dr. Casey:

So, what we know is that women tend to be at increased risk for a variety of types of knee injuries. One of the common ones is called

runner's knee, which certainly can happen in runners, but can happen in women of any type of activity, whether they're doing a lot of stair climbing or even skiing, playing a sport like basketball. And this injury or issue tends to cause pain around or behind the kneecap, and it can feel like stiffness after sitting for a long time and certainly sharp pain with stairs or jumping and running. And, interestingly, while the pain is in the knee, the issue is usually closer to up at the hip, or even further down at the foot and the ankle. So, we like to call this connection between the hip, the knee, and the ankle, the kinetic chain. All those bones kind of work together and oftentimes what happens is if women are a little bit weaker up in the muscles at the hip, or down at the foot and the ankle, they can start to develop pain around the knee. So while the pain is at the knee, the focus of treatment and rehabilitation, rather, is getting women stronger above and below the knee to decrease that pain.

The other knee issue that is much more common in women than men, or that women are at increased risk to develop, is an injury to the anterior cruciate ligament, or the ACL. And so, that can be a pretty big deal because it's a main stabilizing ligament of the knee, and when it's torn sometimes patients choose to have surgery, sometimes they choose to have rehabilitation and a brace, but either way, the recovery is really long. At the shortest time, it's about 6 months, and some people taken even 9 to 12 months to return to full activity, regardless of which treatment plan they choose. And so, as you can imagine, there are both psychological costs associated with that as well as medical costs, in the short term, and then, the important thing about that type of injury is that the risk of developing arthritis after an ACL injury can be quite high, up to 90% higher in the knee that's injured, versus the person's other knee. And we know, certainly, osteoarthritis is a big issue in our country and across the world, and so, that's one of the things that we've paid a lot of attention to in trying to prevent in female and male athletes. And we can certainly talk about that prevention at length, but generally speaking, we try to teach athletes to land and do running and changing direction positions in as safe as a possible position, because when people's knees start to kind of collapse to the middle, towards the other knee, that tends to be a risky position and increases the potential for injury.

Dr. Caudle:

And what about a woman's menstrual cycle? Can athletic performance be impacted by a woman's menstrual cycle?

Dr. Casey:

It's been an interesting topic that highlighted in the media recently. Certainly, in this last Olympic cycle, there were a couple of athletes, particularly one of the Chinese swimmers that referenced how she felt her performance was related to her menstrual cycle. So, it's something that, I think, female athletes are becoming increasingly willing to talk about, and it is actually one of the major areas of my research, related to sports medicine injury, as well as performance. And so, the basic gist of what we know is that the sex hormones that our bodies make, for part of reproduction and the menstrual cycle, in women, the main ones are estrogen and progesterone. And so, in a female to have a menstrual cycle, what happens is the menstrual cycle starts with menses, or bleeding, and then, at that point in time, both estrogen and progesterone are kind of at their lowest levels. Over the course of the next 14 days, estrogen rises to its peak, while progesterone stays low, and that triggers ovulation. And then estrogen drops a little bit and about 6 days later, progesterone peaks and estrogen has another little peak, not quite as big as the first one. So, I apologize for all that kind of review of the menstrual cycle physiology, but it's important because those two hormones actually have receptors throughout our musculoskeletal system. So, they have receptors in ligaments including that ACL that we talked about. They have receptors in tendons, in muscles, in bone, as well as in our brain and our spinal cord. In addition to those two hormones, testosterone which is in men and women, but more so prevalent in men, as well as relaxin, which we think usually as a pregnancy hormone, but that one also fluctuates across the menstrual cycle. And so, part of the research that I'm doing, as well as others, is trying to understand what implications does that have on these tissues in performance. And so, that's an area of active research, but what it seems like, at this point and in the early research, is that tendons and ligaments tend to get looser around the time when estrogen is high, which, interestingly, is also the time in the cycle when that ACL injury tends to be more likely to occur in women. The excitability of the spinal cord and the brain tend to relate to estrogen, so more excitable, potentially more reactive, when estrogen is high; less excitable when progesterone is high. So, that might lead into performance. Things like reaction time, potentially, could change across the menstrual cycle; in some studies they do. And so, all of those things together, I think we have more questions, unfortunately, than answers right now, but there is evidence to suggest that kind of basic structure and function of our tissues changes across the menstrual cycle and that potentially performance could too. But, I want to make sure that I make the point that this doesn't mean that women have no hope of kind of having good performance across the menstrual cycle, because there are some people that feel like they're not very affected. And then, but by understanding it better, for those women who do feel like their performance changes, by understanding what's happening, we can hopefully give them information to potentially change training and competition that would meet their sort of individual physiologic need. So, the last thing we ever want to do is make women feel like they shouldn't participate, or that it's risky to, and their menstrual cycles are a deterrent. I think, quite frankly, we just haven't studied it enough and we don't understand it well enough to give women the right information.

Dr. Caudle:

What is female athlete triad and why does it affect performance?

Dr. Casey:

So, the female athlete triad was a phrase that was first mentioned in the medical literature around 1997. And basically, the definition has evolved, but the original definition was what doctors had found was there was a link between athletes who were demonstrating signs of an eating disorder, like anorexia, so not eating enough, and then they found that they would stop having a regular menstrual cycle, so they wouldn't have any periods, and then, ultimately, they would demonstrate low bone density as well as stress fractures. And as you can imagine, the thing that brought people into doctors' offices, like myself, in sports medicine, were the stress fractures, because that was keeping them from participating in sports. And then, the other factors, the eating disorder, or not eating enough, as well as the loss of the period, were things that were found to be associated. And then really, that definition has evolved to the more current understanding where, right now, the way we accept the definition is an athlete doesn't have to have an eating disorder, like anorexia or bulimia, but they may just not know how many calories, or what type of calories they need to eat to give them appropriate nutrition to do their sport. And in that case, even though they're not trying to lose weight or restrict their calories, they can still start to develop menstrual irregularity, meaning they could lose their period, or it could just become less frequent. And those athletes still, while not as severe at high risk for stress fractures, as well as not achieving their kind of peak, or the amount of bone mass that they should be achieving, as they grow up to about the age of 30. And so, while it's a short-term issue in that they have stress fractures and they're not in a healthy kind of energy balance, but in the grand scheme of things, of course, they're not building enough bone, and really, all the bone you build until you're 30 is all you get for the rest of your life. And so, when they go through menopause later, they're at much higher risk for things like hip fracture, or wrist fracture if they fall. So, it's a really interesting kind of connection between nutrition, reproductive endocrinology, and bone health that has really received a lot of attention, which is great, because the more people know about it, the less likely it is to happen. And the best news for these athletes is, like I said, most of the time it's an education issue where they don't know how much they should eat or what they should eat. And they also don't know that not having a period, it can be common in their sport, but it's not normal and it's not healthy. So, by telling them this, and kind of making sure they understand, we hopefully can give them the educational tools that they need to not have this happen and be a recurring issue with stress fractures.

Dr. Caudle:

Now, when is it time for female athletes to seek out a physician?

Dr. Casey:

And I think that this rule of thumb goes the same for male athletes as well as pediatric athletes. The general rule of thumb that I give my patients is, one, if they're having pain that affects their daily activities. So, they played volleyball during the morning and then going to work later in the day, or class, they're having trouble walking across campus, for example. Two, if they're having pain that's keeping them up at night, that should always be evaluated. I think three, if they can't play their sport or do their activity in the way that they would like to, because they're either thinking about the injury or the pain, or they feel like that's preventing them from landing in the way they would normally, or something like that, that certainly needs to be looked at because it can increase their risk for further injury. And then finally, I would say, if they have done some modifications to their training, talked to their coach and changed things, and they're really not able to improve or change the pain, that's definitely a time when they should be looked at. And like anybody, if they're having other concerning things going on with their health like fevers or feeling otherwise unwell, nausea, any of those things that sometimes can go along with musculoskeletal problems, they should certainly be checked out.

Dr. Caudle:

And what are some of the recent advancements and developments with research in female sports medicine?

Dr. Casey:

The ideas of why there are differences between men and women and how injuries develop and how people recover is a really kind of a young, but active, area of research, and I think this goes along the lines with personalized medicine. As science evolves and starts to understand genetic factors in injury, and again, in my lab and in our role\*12:19 we look at sex and gender, but the more personalized we can be with people about why the injury happened and preventing it from happening again, or preventing it in the first place, I think really equips us to change a lot of different musculoskeletal injuries, hopefully. And so, preventing the first injury can keep people active, prevent obesity, prevent heart disease, prevent some types of cancer, and also not have people dealing with very painful and debilitating osteoarthritis, or back pain, or something like that later in life. And so, more specifically, though, I think in women the idea of preventing ACL injuries in the knee, for example, is a huge area of research, concussion, which we know is a big, kind of hot topic in sports medicine in the past decade or so. One of the interesting findings with the further research that has been done has shown that not only are females at increased risk in sports like soccer, to develop concussions, but their recovery is different. And so, maybe the scales at which we're measuring whether an athlete is ready to return, need to be different for men versus women, or changes to the actual sport, like how old girls should be before they start heading the ball, for example, have people start to explore those in research. So, it's a huge, huge area of investigation, and my interests in this stem from the fact that, while I always wanted to do sports medicine,

but I remember reading some of these papers about that women were at increased risk for these injuries and my initial thought was, “Well, that’s unacceptable, and we have to figure this out,” and that’s led to, hopefully, a long research career in understanding that better, because sports have played a great role in my life, but also I can see what a difference it makes my patients’ lives. And so, really, the goal with our center and our research is to keep women active, as we say, across the lifespan and enable them to pursue their passions.

Dr. Caudle:

And in conclusion, are there any final thoughts about sports medicine, in relation to female athletes, that you would like to share with us?

Dr. Casey:

I think we’re just at the forefront of starting to ask some of the important questions for women, and hopefully change, which will hopefully drive change in how, I think, women perceive themselves and their athletic abilities, but also how we treat women from a medical perspective. So, one example of that would be, you know, I see a lot of pregnant women and postpartum women that are trying to get back to activity, and pregnancy, while of course is a very important reproductive event, it’s a huge event, whether it’s a vaginal delivery or a C-section, on a woman’s musculoskeletal system. Not just the pregnancy, but the delivery. And any other big event like that in the musculoskeletal system, we’d probably treat with a lot of rehabilitation, some education, people seeing physicians. And this is one of these areas that I think is largely ignored in our country. I mean, there are certainly other countries where we treat this differently, as a musculoskeletal event, but hopefully, research and change in care will focus around things that don’t seem to be sports medicine for women, but really are. Like pregnancy and delivery, or menopause, where peoples’ bodies and physical demands and loads will change, and if can address that sort of proactively, with what we call pre-habilitation and education, then I think we’ll enable women to have an easier time with some of these changes that are not thought to be musculoskeletal but really do have big implications on function, on ability to do peoples’ jobs, provide childcare, and all those things. So, we’d like to beyond, which, you know, the parts about sports medicine that we do already, which is performance and injury, prevention and treating, I think kind of going beyond and looking at function and musculoskeletal care as a whole for women, could be significantly improved and we certainly hope to be a part of that change at the Penn Center for the Female Athlete.

Dr. Caudle:

Dr. Casey, thank you so much for being with us today and sharing your insight on the female athlete.

Dr. Casey:

Thank you.

Dr. Caudle:

I’m your host, Dr. Jennifer Caudle. Thank you for listening.

Narrator:

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