

Investigating the Cause of Muscle Cramps

Susanna Levin

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Involuntary muscle contractions are familiar to nearly every patient, partly because cramps have several possible precursors. Although muscle cramps do not have any serious long-term medical consequences, they can be uncomfortable and knock an athlete out of a game. The key to treatment and prevention can often be found in the cause.

Muscle cramps are the common cold of sports medicine. Like colds, involuntary contractions of skeletal muscles are temporarily debilitating but have no serious long-term consequences. Muscle cramps are also extremely common, incompletely understood, and hard to prevent. Unlike colds, however, the acute symptoms of muscle cramps can be quickly relieved (see "Muscle Cramps: Untying the Knots," page 115).

"Cramps are fairly easy to treat in terms of immediate resolution, but they're hard to treat in terms of preventing recurrence," says Wayne B. Leadbetter, MD, medical director at the Shady Grove Center for Sports Medicine and Rehabilitation in



Scientific research has yet to find a direct cause of muscle cramps. But clinical experience has associated cramping with a number of factors, including improper hydration, electrolyte imbalance, changes in ambient temperature, and fatigue.

Rockville, Maryland. Immediate treatment means getting the muscle out of spasm to relieve pain and to allow active patients to soon return to exercise. True success in battling muscle cramps, however, is accomplished through prevention.

Methods for cramp prevention vary, depending on the individual patient and the cause of the con-

tractions. In most cases, changing a patient's training habits or diet is effective. Recurrent cramps can also be a symptom of more serious circulatory, neurologic, or metabolic disorders.

Night Cramps vs Heat Cramps

Muscle cramping is associated with certain diseases, but millions of

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people suffer from cramps without having any underlying disorder. Muscle cramps are often, but not always, associated with physical activity and can be roughly divided into two basic categories: night cramps, which include any cramp that occurs while the individual is at rest, and heat cramps, which are associated with dehydration and electrolyte imbalance.¹

Night cramps most often strike the gastrocnemius and the small muscles of the foot.¹ "Restless legs" is a variant of night cramps, in which spontaneous neuromuscular activity makes the patient's legs move. "Restless leg syndrome is a familial entity, and there are medications which may be of benefit," says Rebecca Jaffe, MD, a family physician and medical director at Pike Creek Sports Medicine Center in Wilmington, Delaware.

Other muscle cramps are associated with the first stage of heat stroke, says Leadbetter, who is also clinical assistant professor of orthopedic surgery at Georgetown University in Washington, DC. This type of cramping is extremely common among athletes who perform in hot weather. Heat cramps typically occur after an hour or two of work in the heat, although they can strike as long as 18 hours after activity, when the individual is at rest. Twitches may precede the cramping episodes, which can recur for days.¹

Heat cramps are most likely to strike the muscles of the hand and

the large muscles of the arms and legs.¹ Occasionally, these types of cramps occur in the abdominal wall, particularly in female sprinters, says Carol L. Otis, MD, director of Specialty Clinics, Student Health Services, and assistant team physician at the University of California, Los Angeles. Scar tissue from small muscle tears in the wall of the rectus abdominis are thought to contribute to these cramps, says Otis, who also serves as a volunteer team physician for Indianapolis-based USA Track & Field, the national governing body for amateur track-and-field competition.

"The pain may be moderate to severe and may mimic that of appendicitis or a burst ovary," Otis says. "That can be a scary muscle cramp syndrome, and you have to rule out other causes before diagnosing it."

What Causes Cramps?

Scientific literature has yet to confirm the causes of muscle cramps. They are thought to have several precursors. Individual susceptibility to cramps appears to be high. "Just as some people are predisposed to getting heat stroke, some people are prone to muscle cramps," Otis says.

The exact mechanisms of heat-induced cramps are not known.² However, electrolyte imbalance associated with dehydration is generally thought to be a factor, says Michael Sawka, PhD, chief of the Thermal Physiology and Medicine Division at the US Army Research Institute of Environmental Medicine in Natick, Massachusetts.

Heat cramps seem to be more common in the beginning of the

summer when people are not yet acclimatized to the heat and lose more electrolytes in their sweat, Sawka says. "As you're acclimatized later in the summer, you don't usually see as many muscle cramp problems associated with heat injury," he says. "Again, this is probably because you're retaining your electrolytes better."

People who engage in events longer than 2 or 3 hours may have more difficulty maintaining electrolyte balance. During such events, Jaffe says, they may need to consume sports drinks that contain low concentrations of electrolytes.

Individuals who have naturally low levels of electrolytes such as potassium and sodium, or of minerals such as magnesium and calcium, may be predisposed to cramps, Jaffe says. Someone who has an adequate diet should have adequate supplies of these nutrients, she says. But dieters who exercise are particularly susceptible to these types of cramps. Patients may be able to reduce their risk of cramping by changing their diets to include these nutrients, she says.

Electrolyte deficiencies can also result from prolonged illness, particularly with vomiting or chronic diarrhea, or from taking diuretics or laxatives. Finally, Otis says, if a patient has a problem with electrolyte balance, the physician needs to consider bulimia. People with eating disorders are reluctant to disclose that they are engaging in purging behaviors. "But cramps can tip you off," she says.

The causes of muscle cramps defy easy categorization. For example, rapid decreases in ambient temperature also seem to predispose peo-

Gaining insight to the cause is crucial in resolving recurrent cramps in active patients.

—Wayne B. Leadbetter, MD

ple to muscle cramping. "You can almost count on it: The minute you have a night game in cool, fall weather, you see cramping," Leadbetter says.

Fatigue may be another significant predisposing factor for some muscle cramp episodes, says Leadbetter. "Fatigue, as defined by decreased contractile ability, creates a reduction of load-to-failure capacity and ability to absorb energy; if you have added metabolic stresses, such as dehydration or electrolyte imbalance, you have a common clinical pathway to muscle cramps or muscle injury," he says.

The true culprit in fatigue cases, Leadbetter says, is improper training. The patient has either trained too hard or isn't getting proper rest or hydration. Improper transition in training is also a common precursor to cramps. Changes in activity level and technique, changes in environmental conditions, such as shoes or surfaces, and body growth can all affect training, Leadbetter says. It may be that such changes in biomechanical or metabolic demands lead to fatigue, and thus, cramping, he says. Deconditioned people who overdo it often end up with this type of cramping. Similarly, injuries can lead to compensatory overloading of other musculoskeletal structures, such as tendon or bone, and lead to cramps.

Cramp Relief

There are almost as many treatments for cramps as there are theories about their cause. The most common and still most effective first aid for cramps is to stretch the cramped muscle, Leadbetter says. For example, dorsal flexion of the

ankle relieves a calf cramp.

Massage is widely used for short-term resolution. Massage may work by increasing blood flow to the area; improved circulation may also help remove metabolic waste products that may be contributing to the muscle contraction.

Similarly, local application of ice can cause a reflex increase in circulation once the ice is removed, says Valerie Sinkus, PT, director of Professional Physical Therapy Associates in Whittier, California. "With ice, you also get a numbing effect which may help the athlete relax," she says. In cold-weather conditions, Sinkus suggests stimulating circulation with heat instead of ice.

Fluid replacement should begin immediately. Some physicians recommend people drink beverages with low concentrations of sodium and other electrolytes. If dehydration is severe, however, or if there is an underlying electrolyte imbalance, these measures may not help. "It may be too little, too late," Jaffe says.

Sinkus, who works with collegiate and professional athletes in a number of sports, uses microamperage electrical stimulation to treat cramps on the field. "The electricity seems to normalize the muscle more quickly. It enables them to resume competition faster than anything else I've ever used," says Sinkus, who carries a small, handheld unit onto the field for treatment.

An even more unusual method for cramp relief is pinching the athlete's upper lip. This unusual technique may somehow alter the neural transmission to the contracting muscle.³

Keep Digging

The key to resolving recurrent cramps, particularly in active patients, is to gain insight into the cause, Leadbetter says. "You have to look into the athlete's history, and be familiar with the training regimen and the stresses of the sport," he says, noting that the reasons for cramps may be entirely different in a wrestler, a fencer, and a cyclist. "Almost always, you can find some contributing factor," such as improper hydration, fatigue, or overtraining, he says.

Recurring muscle cramps may be related to more serious problems. "Sporadic ones are not generally a concern, but when they become more regular you certainly want to look into other possibilities," Jaffe says.

"With regularly occurring cramps you want to rule out vascular problems, diabetes, neurologic problems," says Jaffe, who recounts the case of a patient who initially presented with intermittent leg cramps and was eventually diagnosed with multiple sclerosis. "That's not common at all, but you always have to think of zebras, unfortunately." **FSM**

Stretching the cramped muscle remains one of the most common first-aid treatments, despite the proliferation of other methods.

References

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Bryant Stamford, PhD

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Muscle Cramps

Untying the Knots

A cramp is a muscle contraction gone haywire, locking the muscle into a painful and sustained spasm. Cramps differ from normal muscle contractions, such as flexing your biceps. You have no control over when a cramp strikes, and if you don't intervene, it will continue.

Everyone is vulnerable, from the elite athlete to the couch potato. The calves are the most likely site for a cramp, but any muscle in the body can succumb. And muscles can cramp anytime—in the middle of a hard tennis match or during a sound sleep.

Cramp Creators

What causes cramps? No one knows for sure. Scientists do know, however, that several factors are associated with them. Muscles that are overtaxed, injured, or exposed to extreme temperatures may be particularly vulnerable. And there are other factors.

Dehydration may be the most important factor. Muscles tend to

cramp more easily when your body is dehydrated.

Electrolyte imbalance is also often cited as an underlying problem. The minerals potassium (found in bananas, for example) and sodium (found in table salt and many foods) are called electrolytes because they carry an electric charge that helps trigger muscles to contract and relax. Sweat loss and dehydration can disrupt the balance between potassium and sodium. A potassium-sodium imbalance can lead to cramps. The muscle won't return to normal until fluid is replaced and electrolyte balance is restored.

Another possibility is *mineral deficiency*, or too little of certain other minerals in your diet. The two most important of these are calcium and magnesium, which help muscles contract and relax.

Muscle cramps may also stem from an *underlying condition*. Diseases such as clogging of the arteries (atherosclerosis) or diabetes may be the source. And pregnant women may notice an increase in muscle cramps. No matter what your condition, if you have continued cramping after trying to address the possible causes (see below), consult your doctor.

Cramp Busters

Regardless of the cause, the treatment for cramps is the same. For immediate relief, gently stretch the muscle as best you can. (Pain may



limit your ability to do this.)

When you stretch a contracted muscle, you increase the tension on the tendons, which are elastic bands that attach your muscles to your bones. If there is too much tension on a tendon, your nerves inform your brain that the tendon may be pulled off the bone. Your brain responds by sending a message for the cramped muscle to relax. Pressing on the muscle, massaging it, and applying ice for a few minutes while stretching also help the muscle to relax and uncramp.

If you have a cramp in your calf, for example, get in as comfortable a position as possible, such as on your back. Then pull your toes and the ball of your foot toward your kneecap. The idea is to lengthen or

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Clip and copy for use as a patient handout.

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stretch your calf muscles.

Stretching other muscles—such as those in the lower back—may not be as easy to visualize as stretching the calves. To stretch the lower back, lie on your back on the floor and draw your knees to your chest. Grasp your knees and pull them gently toward your chest.

This approach is not recommended if you have a back injury, however, because it may worsen the injury. If you suspect an injury, check with your doctor before attempting to relax cramps in your back muscles. He or she will probably prescribe muscle relaxant drugs to ease the cramping.

Warding Off Knotted Muscles

Stretching is a first-aid treatment. It can bring relief, but the relief may be short-lived. This is because cramps are symptoms that something is not right with the muscle. Try these steps to avoid muscle cramps:

Drink lots of water. Prevent short-term dehydration by replacing as much fluid as possible while exercising. It is possible to lose as much as 2 quarts of sweat per hour while exercising vigorously on a hot day. Drink as much water as possible within an hour after exercise. Obviously, you may not be able to replace all of it immediately, but replace as much as possible. Every little bit helps.

Avoid long-term dehydration by drinking several glasses of water each day. Also, check your weight before and after exercise. Assume that all lost weight is fluid and needs to be replaced that day. One pound of lost weight equals 1 pint of fluid. You may have to force yourself to drink to replace all fluids, because you will quench your thirst before

you satisfy your body's needs.

Get enough potassium and sodium. Eat foods high in potassium, such as bananas and oranges. Low-sugar sports drinks that contain potassium supplements can also be helpful if taken immediately before and during exercise.

Although salt lost through sweat can contribute to cramps, Americans tend to consume much more sodium than their bodies need. Therefore, lack of sodium is not common. But if you use salt sparingly and exercise hard, try adding a little more salt to foods.

In the old days, coaches recommended salt tablets to replace the salt lost through sweat. But salt tablets are a no-no. They tend to draw water from your bloodstream and may irritate your stomach.

Build up other minerals. Make sure you get enough dietary calcium and magnesium. Good sources of calcium include milk, yogurt, salmon, sardines, shrimp, dark green leafy vegetables, and dried peas and beans. Vitamin C helps your body absorb calcium, whereas eating too much protein interferes with calcium absorption. Good sources of magnesium include nuts (especially almonds and cashews), apricots, whole grains, dark green leafy vegetables, and soybeans.

Wear proper clothing. Anything that interferes with blood circulation (cold weather, for example) can contribute to cramping. To avoid exposing your muscles to sudden and extreme changes in temperature, keep them covered. Examples include the jackets baseball pitchers wear between innings and the clothing hikers and bikers wear to protect against windchill.

Also, avoid tight clothes and tap-

ing. Exercisers who wear tight-fitting elastic around the knee or who tape their lower legs and ankles may restrict blood flow to the lower leg. Less blood to the muscles contributes to cramping.

Shape up. Although no one is immune to muscle cramps, poorly conditioned muscles appear to be most vulnerable. This may be because out-of-shape muscles are quickly fatigued. It also could be because people unaccustomed to exercise will lose more sodium and potassium in their sweat than will those who regularly exercise in the heat.

Stretch. Stretch before exercise and throughout the day. If you suffer from nighttime cramps, stretch before going to bed.

Go slowly. Allow your muscles adequate time to make adjustments. Don't shock them. Something as simple as slightly changing the heel height of your shoes can increase the stress on your calf muscles, resulting in cramping. Break in new shoes gradually, wearing them for short periods at first until the muscles become accustomed to the new angle.

Ask about prescription drugs. Taking quinine tablets may help prevent persistent muscle cramps. Ask your doctor for advice.

Uncramp Your Workout

Muscle cramps may be painful, but they needn't defeat you. Lots of water, adequate electrolytes and other minerals, and going easy on your muscles can help you uncramp your workout. **PSM**

Remember: This information is not intended as a substitute for medical treatment. Before starting an exercise program, consult a physician.