



The Syme Ankle-Level Disarticulation: Heels and Healing

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Choosing an amputation level is not always easy. The surgeon helps an individual patient understand and balance a complex set of variables.

The goal, however, is always successful healing, preserving as much function as possible, and creating a residual limb that will work best with a prosthesis. Working as a team, we must weigh the benefits of different procedures with the possible downsides and decide on the wisest course of treatment.

My previous column focused on the partial foot amputation and some of the thoughts involved in saving part of the foot. Frequently, the amputation level will need to be higher than the person had anticipated. If the front of the foot is involved, we think of surgery in the middle of the foot. When the middle of the foot is involved, we consider surgery at the back of the foot or at the ankle. The higher amputation level becomes necessary as part of our plan to preserve and create the best residual limb possible, given the circumstances. Decisions concerning the amount of bone and soft-tissue padding to be preserved are vital in determining how well the residual limb may best serve the person in the future.

Now, we'll examine a specific type of ankle-level procedure sometimes referred to as the Syme amputation. Dr. James Syme pioneered this technique in the 19th century, and it initially gained favor because it was safer than other surgical methods available at

that time. This procedure is called a disarticulation, and it is performed by removing the foot between the bones of the ankle joint so that there is less cutting of bone. Disarticulations were developed more than a century ago as a way to lessen bleeding and shock during and after surgery. Surgical techniques have improved greatly since then, however, so the risks of death or major complications during amputation are no longer as great.

In this procedure, as in other amputation surgeries, our focus should be on soft tissue and creating the most functional residual limb possible. Sacrificing some skeletal length can help to maximize the possible benefits of extra padding at the end of the limb. The ankle-level disarticulation removes the dysfunctional part of the foot while saving the heel pad – that unique, resilient tissue at the bottom of the foot that acts as a shock absorber while we're walking.

Why doesn't the heel get the respect it deserves? Why do we call a cad a "heel"? Why would author Malcolm de Chazal say, "The idealist walks on tiptoe, the materialist on his heels." Even way back in the 1800s, Dr. Syme was aware of the heel's vital importance as padding and to absorb the shock of weight-bearing. The heel pad is tough and cushioning, resilient and good.



Choosing Wisely

There is no crystal ball to tell us the outcome of any course of action with 100 percent certainty; therefore, our decisions involve weighing what is possible, reasonable and wise against the risks of healing problems, nonunion of bone, and infection. It's shortsighted to think, "We'll try the longest level amputation first, and if that doesn't work, we can always amputate again at a higher level." Multiple surgeries can mean multiple risks, such as complications from anesthesia, heart attack, stroke, bedsores and urinary tract infections. And each surgery zaps a person of nutritional reserves, energy and enthusiasm. The opportunity to heal

and recover is significantly diminished when a patient undergoes several successive surgeries in a short time period. When you spend every day in bed over many weeks, your muscles get weaker and your energy declines. You become “deconditioned,” and it becomes much harder to regain the muscle strength and balance that was lost.

Say, for example, a person has ulcerations and infection of the bone in the front of a foot. The initial amputation is done in the midfoot, but the wounds don’t heal. Next, the surgeons amputate at the ankle, but infection sets in. The problems continue so a third surgery is done at the calf. The calf-level amputation finally heals, but the person has been put through such an exhaustive process that full recovery may be difficult, even impossible. Had the person decided to undergo a calf-level amputation initially, followed by a very aggressive program of recovery and rehabilitation, the chance of his or her regaining vital function would have been greater because there would have been far less “down time.”

My mentor, the late Dr. Ernest Burgess, said it’s a surgeon’s obligation to carefully balance all the factors, good and bad, in surgery and work together with the person to decide on the wisest amputation level. Obviously, it’s not good to amputate more of a limb than is necessary, but it’s as bad or worse to simply say, “We’ll amputate more later if it doesn’t heal,” and risk putting the person through two or three surgeries. The crux of a surgeon’s thinking when considering the amputation level should be: “What is best for this individual in these circumstances?” There are pluses and minuses with any decision.

The Pluses and Minuses of an Ankle-Level Disarticulation

An ankle-level disarticulation enables us to preserve a great deal of length and have very durable tissue at the end of the residual limb, the heel

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pad. With this unique combination, some weight-bearing may be possible, although, historically, physicians have probably overstated the actual ability of a person with a Syme amputation to walk without a prosthesis. While some individuals can take a few steps without their artificial leg, especially when transferring and getting around the bathroom, most need a prosthesis for routine walking. The ability to take even a few steps without a prosthesis is significant, however. A person with a transtibial-level amputation is unable to do this at all and must resort to hopping or crawling. With a Syme amputation, very limited walking without a prosthesis is possible.

Ideally, a surgeon also prefers to preserve the entire muscle or as much of it as possible. With an ankle-level amputation, the muscles of the calf are allowed to remain in a more natural state than they typically would be with other amputation levels. The ankle-level amputation only involves dissecting through tendons, not through the middle of the muscles. Therefore, there aren’t the dramatic changes in the muscles of the calf that can be found in other amputation levels, such as transtibial-level surgeries in which muscle is

actually divided. Plus, tendons are far more capable than muscles of holding sutures.

The shape of a Syme amputation can, however, be a problem for some. Amputations generally result in one of three shapes to the residual limb: cylindrical, conical or bulbous. The optimal goal is a more cylindrical shape. Frequently, though, the limb is gently conical in form, tapering from larger at the top to thinner at the bottom. Unfortunately, an ankle-level disarticulation almost always results in a bulbous shape because of the underlying shape of the bone at the end of the limb and the thick nature of the heel pad.

One problem is that the bulbous shape can be difficult to get through the narrow bottleneck of a prosthesis, and, thus, the socket has to be specially designed so that part of it opens and closes like a trap door to allow the person to maneuver the limb in and out. A hidden plus, however, is that once the residual limb is inside, the socket won’t fall off. How the prosthesis is held onto the limb is called suspension, and there are many ways to obtain it. With a bulbous limb, the person gets self-suspension, where the socket forms around the limb in such a way that it can’t be pulled off inadvertently.

When the calcaneus (heel bone) is removed, the heel pad must be repositioned to provide padding for the end of the tibia. It is this relocation of soft tissue that gives the end of the limb its bulbous characteristic. In practical terms, this can be very useful because tissue in the heel pad is designed for weight-bearing and is made up of honeycombs of fibrous tissues that contain fat and work as mini shock absorbers.

Originally the heel pad is firmly attached to the underlying heel bone. Unfortunately, with an ankle-level disarticulation, it can be difficult to keep the heel pad centered under its new surgically created bone

attachment, the tibia. Surgeons have tried many techniques to accomplish this, but none is perfect. The heel pad can drift, and if thinner skin is subjected to weight-bearing, it becomes susceptible to sores and ulcers, and surgical revisions may be needed. While some people do well with an ankle-level disarticulation for many years, the soft tissue can wear out as the pad drifts. A number of my patients had success with a Syme amputation for years, even decades, then eventually had to have the amputation revised higher to the transtibial level. Though we can revise the Syme procedure by trying to re-center the pad or by going to a higher amputation level, both ways involve more surgery.

For some people, the ankle-level disarticulation can work amazingly well. For others, it can be a big problem. The best results generally occur when the heel pad remains centered, is nontender and can bear weight. If the heel pad is involved in the injury or disease, it may be scarred, tender and prone to ulcerations or sores. Then the outcome may be complete failure. While meaning well, the surgeon who saves a damaged heel pad leaves a residual limb that's bulbous, tender, and more difficult to fit with a prosthesis. A prosthesis for a typical ankle-level disarticulation takes advantage of some end-bearing. If the heel pad is damaged, however, the tender end will need protecting and won't be nearly as useful. A surgeon might have good intentions and say, "I've heard the Syme is better for end-bearing than the transtibial amputation. We'll try to do it, even though the heel pad is damaged." But a very poor outcome is much more likely in this scenario, and for the patient, it can become a real problem. Skeletal preservation should not be of paramount concern if it means the person is going to have to live with a residual limb that is painful, dysfunctional, or both.

Another problem with the bulbous end is cosmetic. When you combine



the thickness of the heel pad with a very long socket and a prosthetic attachment – and all that volume is located just an inch or so off the ground – the ankle area looks very wide. In a transtibial amputation, the extra volume can be located higher up the leg, leaving a tapered ankle. With a Syme amputation, there's nowhere to hide it. In other words, the ankle looks really, *really* fat, and the appearance can come as a shock to those who have seen reasonably attractive prosthetic devices for certain amputation levels and expect theirs will look the same. When a person first sees the prosthesis following an ankle-level disarticulation, he or she may be very disappointed with its appearance.

Children and Syme Amputations

Children undergo ankle-level disarticulations more commonly than do adults, and the outcome is more predictable. By the time kids are finished growing, the bulbous end of the limb has often diminished because the heel pad and the end of the tibia grow less as a result of their new roles. Bone grows in response to its function and the forces exerted upon it. When the heel bone is removed, there is nothing growing under the heel pad to stretch it, and, consequently, the heel pad doesn't grow as much. Often, at the time of skeletal maturity, the final shape of the limb is cylindrical and much easier to fit

prosthetically.

Many kids facing this amputation have very complex leg inequalities. For example, the tibias in the lower legs and the femurs in the thighs may be different on the right and left sides. With careful surgical planning, however, the growth of one or more bones may be stopped to balance this. The growth of the tibia in the leg with a Syme ankle-level amputation can be stopped at the appropriate time, leaving a limb the same length as a long transtibial amputation with the added benefit of a durable heel pad and end-bearing capabilities. The added space below the amputation also creates extra room for high-tech components in the prosthesis.

Thinking it Through

Ankle disarticulation is an amputation level that makes us consider a wide variety of issues and balance the differences in comfort, function and appearance that might be possible. We know the prosthesis for a Syme amputation is more difficult to make than one for a transtibial amputation and that it is not as attractive as a prosthesis for a higher-level amputation. We must, however, balance these factors with the more positive possibilities: Will it be worth it for the person to have the advantages of some limited end-bearing? Is self-suspension of the prosthesis worth the trade-off in appearance? These issues are complex, and medical professionals are divided over the values of the various benefits and drawbacks. How do you assign a specific value to each plus and minus when people value the pros and cons differently?

My impression is that fewer ankle-level procedures are done now than in the past. I believe this mostly has to do with advancements and improvements in transtibial surgery. Anecdotal literature seems to indicate that the ankle-level procedure may allow for a small increase in function over a transtibial amputation. The benefits of transfers

because of the stronger calf area and a longer mechanical lever arm probably are more substantial. Limited weight-bearing without a prosthesis is another benefit. But Syme amputations can result in more problems with prostheses and are not aesthetically desirable to some people.

We actually don't know how to measure and add up all the functional aspects to truly compare Syme amputations to transtibial amputations. As the function of the transtibial amputation limb has gotten much better in recent years with improved prostheses, the comparison is even more difficult. In my own practice, I perform fewer ankle-level amputations now than I did in the late 1980s and early 1990s because of improvements in transtibial prostheses and some of the drawbacks that can be inherent with the Syme procedure. In addition, patients have higher expectations about the appearance of their prosthesis than ever before. However, given all of that, there still remain situations where I believe that a Syme amputation is the wisest option. ■



Science, Love and the Boss's Daughter



Joseph Lister

Professor James Syme was head of surgery at Scotland's Edinburgh Royal Infirmary in 1853 when a young doctor, Joseph Lister, was

appointed house surgeon there. As Lister improved his surgical skills under Syme, he also fell in love with Syme's daughter, Agnes. The feelings, happily, were mutual, and the two were married for 37 years.

Lister eventually won the appointment for Syme's position as professor. Though he was noteworthy for his medical skills, marrying the boss's daughter didn't hurt!

Lister, however, gained international renown in his own right for antiseptic techniques in the operating room that greatly reduced the need for amputations. A device he introduced emitted a fine mist of carbolic acid during operations, and this form of antiseptics came to be known throughout the world as "Listerism."

