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## **Determining the Etiology of Wounds: Pressure Versus Vascular**

- Presented by Jeri Ann Lundgren, RN, BSN, PHN, CWS, CWCN **Pathway Health Services**  
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### **Kristi Wergin**

I would like to welcome you to this educational session entitled '*Determining The Etiology of Wounds; Pressure Versus Vascular*'. Our featured guest speaker is Jeri Ann Lundgren. Ms. Lundgren is the director of Wound and Continence Services at Pathway Health Services and the Director of Clinical Services at Gulf South Medical Supply. She's a national wound care consultant and is board certified by the Wound Ostomy and Continence Services Society and the American Academy of Wound Management.

For more than 10 years, Jeri has provided consultations on wound care, developed and presented staff educational programs locally and nationally, and has developed effective policies and procedures for wound care management. She has also worked both with crisis management and litigation support in a long-term care industry. Welcome Jeri, and thank you for being with us today. I'll now turn the presentation over to you.

### **Jeri Ann Lundgren:**

Thank you Kristi and welcome everybody to Determining the Etiology of Wounds; Pressure Versus Vascular. What this training module will do is help you assess the different types of etiologies of wounds, and this is imperative. It's important that you identify first and foremost the etiology and the type of wound that you're actually dealing with because that will determine how you're going to treat it and will help determine the prognosis and probability of healing, etc.

It's very important to note the differences between what's a pressure ulcer versus wounds caused from things like vascular, nature or maybe maturation, things like that because again, that treatment is going to be very different depending on that etiology. So, I'll be walking you through all the different definitions of these types of ulcers.

Now, when it comes to a pressure ulcer, the NPUAP (National Pressure Ulcer Advisory Panel) defines a pressure ulcer as a localized injury to the skin and/or underlying tissue usually over a bony prominence as a result of pressure or pressure in combination with shear and friction, and that's a very important definition. So when you're at that bedside looking at the characteristics of the wound, you're trying to determine does it fit that definition of a pressure ulcer. Is it over a bony prominence?

The reason why pressure ulcers are more prone to being over bony prominence is because that tissue between the bony prominence and the support surface the patient or the resident is on gets squeezed and the blood supply gets cut off. However, medical devices can also lead to pressure such as oxygen tubing, catheter tubing and splints. Casts or braces are also known to cause pressure ulcers. It's also important to note that pressure in combination with shear and/or friction can lead to that pressure ulcer formation.

It's important when you do the assessment if you determine it is a pressure ulcer, you need to also determine whether it's strictly pressure feeding to this wound and you need to eliminate that force or do I have shear or friction forces in play that I need to eliminate as well.

It's also important to note that your soft tissue dies off much faster than your skin does. So many times by the time we see any indications that there's a pressure ulcer at that skin level, a lot of times we have the iceberg effect; meaning it's usually a signal that there's a lot more damage underneath. So it's very important that once you start seeing any type of signs at that skin level of a potential pressure ulcer that you act quite aggressively with that.

Now, a pressure ulcer that is solely from pressure only is going to be very well-defined to that source of pressure. In this picture you can see it's well-defined to that bony prominence with a punched out circular and fits the mold of that actual bony prominence.

If you have shearing forces involved, and what shearing means is a rolling effect. So due to friction your skin stays in one condition, but your bones roll in the opposite direction. Many times how a shearing force might happen is if somebody slides down in the bed or in their wheelchair or as staff actually drags a resident instead of lifting them when they move them. It can cause a shearing or rolling effect and shearing forces are very damaging because now you have that tissue being torn all the way down to the bone level because that bone is actually tearing that tissue in an opposite direction where the skin is actually pulling. The other issue with shearing is that when you get that rolling effect it takes off and completely occludes your arteries and capillary beds, so it further decreases the blood supply to that tissue.

Two different ways to note if shearing forces are coming into play is first you might have what's called undermining and undermining is that shelf-like effect underneath the skin.

1. So if your surrounding skin has that little shelf underneath it where the skin is no longer anchored to the underlying structure that is typically from a shearing force that something has happened that has torn that skin away from the underlying structure.
2. The other characteristic that you may see is very irregular edges or, as you see in this picture, kind of elongated.

You can tell this person had actually kind of been dragged and that the wound instead of being punched out circular well-defined to just solely the pressure point, these are elongated and irregular. Shearing forces are very damaging if you do not eliminate what's causing that shearing force, so very important if you see these characteristics to eliminate that.

Lastly is friction and friction is superficial. That means it's very light pressure and friction means it's superficial and isolated to the skin only. Where you might see friction burns is maybe a sheet burn or in this picture of a little lady's shoulder where the bra strap was just a little too tight and caused a friction-type ulceration.

The good news if its friction and you eliminate the source of friction you can heal quite rapidly because they're superficial wounds. However, if the friction is not dealt with, if the pressure becomes greater, it can turn into a shearing-type force and lead to a much deeper-type ulceration.

So that is your definition of a pressure ulcer. Now what I'm going to do is walk you through the lower extremity wounds. We're going to talk about arterial versus venous versus peripheral neuropathy or diabetic-type ulcers.

We're going to start with arterial insufficiency and what arterial insufficiency means is that the blood supply is cut off to that extremity or to that limb. So as you can see in this picture, typically where you're going to start seeing ulceration is below where that cutting off of the blood supply is. It's very important to remember that your arteries bring the blood supply down to that extremity so if they're cut off that will occlude off the blood supply and that tissue will die.

Some characteristics that a resident or patient might have arterial insufficiency is if you lift the extremity up it becomes very pale and then when you bring it back down it has that dependent rubor. You get those people that get those purple feet when they're sitting in their chair or their wheelchair.

Other characteristics you might see due to a lack of blood supply are that shiny, taut, thin, very dry, hairless lower extremity. They also get an atrophy of the subcutaneous tissue, so you see those skinny, little, shiny legs.

The other characteristics you might see or the resident or patient might complain about is increased pain with activity or elevation. It's known as intermittent claudication. Many times these are the residents or patients that at nighttime, due to their feet being a little bit more elevated when they're in the bed, complain that their legs cramp at night and that it feels so much better for them to dangle their feet over the side of the bed. The reason is that by dangling their feet it gets that blood supply back to that extremity.

So if they note pain while in bed and need to dangle their legs or if with increased activity, as you exercise your muscles demand more oxygen nutrients and if they have a poor blood supply it's not going to be able to meet that demand therefore the legs and the muscles will cramp up.

Other characteristics that you might see is that the skin temperature tends to be very cold and decreased because of a lack of blood supply. If you do a capillary refill on the great toe it's usually delayed more than three seconds.

The other piece that you want to assess for is those peripheral pulses. Now, if they're absent or very diminished that's an indicator that you do have a poor blood supply or arterial insufficiency. However, with that being said, I've worked with many residents and patients that do have good peripheral pulses, but due to their capillaries, so those smaller arteries that go out to the toes, so the larger arteries might still have a good blood supply, but you might be seeing wounds on the toes or the toe tips. That is an indicator that it's those smaller capillary beds that are actually being occluded off.

I've had many people call and say I have a wound on the great toe. It's a black eschar. It's looks vascular nature, but I'm feeling a pulse. Just because they have a pulse doesn't mean that they don't have arterial insufficiency, so be very cautious of that. Obviously, though, if it's absent or diminished that's an indicator that they have arterial perfusion issues.

We strongly recommend that if you suspect arterial insufficiency you get what's called an ankle-brachial index. The acronym for that is ABI. What that is, it will take the blood pressure utilizing a Doppler and they will test it against the arm versus the leg. If that ankle-brachial index comes back at equal to or less than .8 they have arterial insufficiency.

If it comes back where they were unable to do ankle-brachial index it's usually for one or two reasons. (A) They already have a wound so they can't slip the Doppler over that wound, so that should tell you there's issue already, or if they have hardening of the arteries it will not pick up on the Doppler. Again, if they're indicating that there's hardening of the arteries most likely then they don't have a good supply going through that artery.

Other tests that can be run – So, again, the ankle-brachial index may be coming back normal through those larger arteries, but you might be seeing ulcerations on the toes. They can do systolic toe pressure and if that systolic toe pressure comes back at less than 30 then that's an indicator of arterial insufficiency. Also, they could run a transcutaneous oxygen to pressure measurement and if that comes less than 40 millimeters then we are to create that as an indicator of arterial insufficiency.

It's very important if you send these residents or patients in for an evaluation by a vascular, many times they will run these tests and a lot of times you don't get the results. So we strongly recommend that you ask the physician if they do conclude that it is arterial insufficiency. I would ask for these tests and what the results were, because it will tell you the severity of the arterial insufficiency and the likelihood if that wound is going to heal or continue to digress. Many times with arterial insufficiency, unless the blood supply can be returned to that area, these are wounds that simply will not heal and many times will continue to decline.

Typically, the location for arterial insufficiency ulcers is on the toe tips and/or web spaces, so it's very important that you look between those toes. The phalangeal heads of the toes and around the lateral malleolus -- so that outer ankle bone -- is very prone to arterial insufficiency. From there a very important

definition on here is that the areas exposed to pressure and/or repetitive trauma from let's say the issue of shoe, cast or brace.

A lot of people will ask if the shoe caused the wound but that severe arterial insufficiency is it pressure or is it arterial? Now, the pressure from the shoe may have contributed to the further decline of that area, but with arterial insufficiency how that wound is going to heal would be very different than if it was a straight forward pressure also that was getting good blood supply so we always go by the underlying etiology. Even if the shoe contributed to it, it would still be an arterial insufficiency wound that had a decline or contributed to the pressure of the shoe. It's important to note then that you might run into issues because you had an ill-fitting shoe, but you shouldn't consider it a pressure ulcer because how we treat a pressure ulcer is very different than how we would treat an arterial wound.

Characteristically, arterial wounds tend to be because there's no blood supply and the tissue dies so they tend to be necrotic. They're usually pretty circular, round in nature, defined wound edges and they're usually necrotic or you might see a really thick callus, especially over that lateral malleolus, that outer ankle bone.

If the wound then does open up, typically because there's such a lack of blood supply you're not going to have healthy granulation tissue. It's going to be dull pink, kind of shiny, kind of smooth in characteristic. That's telling you that it's not getting a good blood supply. Cellulite is common and they tend to get localized infections to these areas because of that lack of blood supply.

You'll see in this slide where it says associated with PVD. It's very important if you have somebody that has a diagnosis of peripheral vascular disease that you clarify it with the physician. Does that mean arterial, does it mean venous, or is it a combination of both? Because as you'll see once I walk you through the venous insufficiency it's very different than arterial and therefore how we're going to treat them is going to be very different. Here's just a good example of that callusing over of that toe, that swelling that you see a lot of times. Actually, you can even see the toenails here are very thick. You have that real dry skin.

Next is venous insufficiency and venous is completely opposite. So now the blood supply is getting down to the lower extremity, but what venous insufficiency is, is your veins bring the blood supply back up to the heart and due to incompetent valves it can no longer bring that blood supply back up to the heart. So, venous insufficiency means that blood supply is not being routed back up.

Characteristically, what you're going to see in the lower leg is blood pooling in that lower leg and then eventually what it does is it seeps out into your interstitial spaces. That is what is causing your edema. It's very important if you have somebody with lower leg edema that you do rule out the fact that it's not maybe from a different type of etiology.

Typically, edema from venous insufficiency or incompetent valves is going to be characteristically in both legs versus like lymphedema you might see edema just in one leg. Typically, edema due to insufficient valves or venous insufficiency will be isolated to the lower leg where again lymphedema might affect the entire limb. So it is important that you look at the characteristics or the differences.

The other characteristic that you're going to see is what's called venous dermatitis. These folks, due to that interstitial fluid just continually irritating the skin of the lower leg, a lot of times they'll develop dermatitis so that it will have that scaly, kind of weeping skin. A lot of times they'll describe it as being very itchy.

The other characteristic you might see is what's called hemosiderin staining. That's that brown staining that you see or that hyper pigmentation that you see in the lower leg. Again, that's from your red blood cells interstitial fluid. Your red cells carry iron and it deposits that brown staining to that lower leg. Also, these folks are very prone to cellulitis. Again, the tissue of the skin is getting irritated by that interstitial fluid and it tends to lead to cellulitis. So if you're admitting someone that has active cellulitis or a history of recurring cellulitis that's a pretty good indicator that they have venous insufficiency issues.

Other assessments you do, pain is typically minimal unless they become infected or dried out. The peripheral pulses if they don't have an associated arterial insufficiency, the peripheral pulses are going to be present, palpable and your capillary refill would be normal in this case.

The location is opposite of arterial. Where arterial tends to be on the feet, toe tips and lateral malleolus, where the location of venous insufficiency ulcers are in the medial aspect of that lower leg and ankle. It can be anywhere on the leg. I've seen ulcers going around the entire circumference of the leg and at any given point wherever that tissue is getting irritated. So typically, between the ankle and the knee you'll see these ulcerations.

Typically, these ulcerations usually start out superficial. Again, it's that erosion of the skin that starts out, so typically they're very superficial. If the resident or patient has a good blood supply, the wound then is usually very granular, almost ruddy in appearance. These wounds tend to continually re-grow what's called 'fibrins', so they appear to always continually have slough tissue on these wounds.

Draining is usually present as long as you deem it as present. Once you get the edema under control many times the drainage then might actually decrease. Again typically, by nature these tend to be painless unless they become infected or dried out. It's also important to note that the term 'stasis' means venous. So stasis insufficiency or a diagnosis of a stasis ulcer that means the etiology of it is venous in nature.

So here characteristically we see somebody that has the hemosiderin staining, as you can see that brown staining. You have the wound that's irregular and is that ruddy granular tissue in there, but you have real irregular wound edges, because again it's not defined like a pressure ulcer to be very defined it's just a pressure point, this one erodes all over the leg.

It's also a little hard to see in the picture, but you have kind of a shiny hairless taut of skin here. This is actually a male that has that lack of hair. You can kind of see where the ankle is a little skinnier due to that subcutaneous.

What's important about the venous insufficiency versus an arterial is again, they are completely opposite of how we're going to treat these type of wounds. In this picture here you will see that the surrounding skin has that dermatitis appearance, but this dermatitis has eroded to the point of a cellulitis, so that bright pink warm scaly skin, you'll see the ulcer there again is very irregular, very superficial and you can see those fibrin deposits. You would just describe that as slough, but that's very typical for the venous insufficiency.

So before I start the peripheral neuropathy, I'm hoping that you see why it's so important to note the difference thus far. With an arterial wound it's not going to heal unless you can re-vascularize it and how we would deal with that would be very different versus them having a good blood supply but they can't get the blood back up and the reason these wounds are happening with a venous wound is due to all that edema. If you don't treat that underlying edema with compression and appropriate type intervention, your wounds aren't going to heal.

So how we treat arterial versus venous is very different and is also very different from how you're going to treat that pressure ulcer.

Lastly is your peripheral neuropathy, many times associated with diabetes. What's very important with peripheral neuropathy is that you do not have to be a diabetic, in order to develop a peripheral neuropathy. In fact, there is well over 100 known causes and one of the number one causes is its hereditary to that.

Peripheral neuropathy is the loss of innervation to that lower extremity. So you lose your nerve endings and because of that you're going to see that different characteristic. So (a) they might have relief of pain with ambulation. These are the folks that are opposite of arterial. Arterial is with activity or ambulation where their legs cramped up because of the lack of blood supply to those muscles. These are the folks that their muscles cramp up and it actually feels better to walk to relieve that pain.

Due to the lack of innervation you'll see parasthesia of the extremity being that loss of sensation, that extremity and with the innervation loss, what happens is those muscles no longer become stimulated in the foot. So what happens is that your muscles atrophy. So you're going to see shifting of the bone structure within the foot.

Many a time you've seen altered gait due to the orthopedic deformity, so if you see people with club toes or any deformities of the feet or that flat arch, that's usually the sign of a peripheral neuropathy. Again their reflexes are going to be diminished and they'll have an altered sensation. Now, as the disease progresses they actually might describe it as like a burning, and a lot of them will describe it as it's shooting pains through their legs or burning pain or it feels prickly every once in a while and those are all indicators that the nerve endings are dying off.

Some folks even get an intolerance of touch, meaning a hypersensitivity before they fully lose sensation to that area and these are the folks that can't stand the feel of bed sheets on their feet and don't like things touching their legs, because that hypersensitivity could be indicating a peripheral neuropathy. The other issue that happens with the lack of innervation is that it doesn't allow the foot the ability to flex, and because of that what happens is the foot tends to callous itself over. So, if you have someone with calloused feet, heels, the base of the foot, fissures, cracks or things like that that's all good indicators that there is a peripheral neuropathy.

What's important about peripheral neuropathy is if you suspect it, many times arterial insufficiency commonly co-exist, so if you suspect they have a neuropathy going on you might want to do another ankle brachial index just to rule out if there is any arterial insufficiency concerns as well.

The other piece that you might want to do with edema, our rules as we discussed, before you treat the venous wound you might also want to do an ankle brachial index just to ensure that you have a good blood supply to that limb before you start any type of compression or things like that. Basically, when it comes to the lower extremity wounds, whether you're diagnosing arterial venous or neuropathy we do recommend you get a baseline ankle brachial index.

Other little bedside tests you can do is take a monofilament, have the resident or patient close their eyes and you'd actually press the monofilament on the base of their foot, the base of their toes or on the plantar aspect of the foot and heel. They're supposed to tell you with their eyes closed when they actually sense any pain with that. It could all make a difference of when you're bending it. You can also use a tuning fork to see if they can actually feel the vibration of that. You can test the tendon reflexes of the ankle and knees to see how they respond. And again, we have on here to do the ABI.

When it comes to neuropathy, typically these wounds tend to be on the plantar aspect of the foot because it's where they can't sense any pain. They tend to start developing ulcers in those areas where they have no pain, potentially on the base of the foot, the metatarsal heads of the toes, the heels and altered pressure points so if there are bone deformities there and very important, sites of painless trauma or repetitive stress.

So again that question, let's say someone has severe peripheral neuropathy or don't have sensation in their foot and they put on an ill-fitting shoe and don't know it, because they can't feel it and develop an ulcer. Many people ask the question then well because of the pressure of the shoe they developed an ulcer, so therefore it's a pressure ulcer. No, again we go by the underlying etiology because someone without peripheral neuropathy would have felt the pressure and probably would have never developed it in the first place.

And also, how a straightforward pressure ulcer with somebody who has got good innervation and blood supply, etc. will heal differently than someone with peripheral neuropathy. In fact, these wounds can be very difficult to heal and have a tendency to become chronic. So it's important you get the right diagnosis for it.

These wounds typically are deep because again, the resident or patient can't feel it or sense the trauma is happening. They tend to be deep before they're discovered. The wound edges tend to be very calloused over and in fact, many times you'll see these wounds callous themselves over versus granulating from the wound bent up. Typically, if they don't have arterial insufficiency, you might see

some granulation and cellulitis and osteomyelitis are very common with neuropathy type ulcers. The reason is if you have a fourth year bone structure sitting in your foot and because these wounds tend to get deep it doesn't take much for you to get bone involvement, therefore, they tend to get osteolitis, which is infection of the bone. It's very common.

The problem with the neuropathic foot is they tend not to show infection very well. They don't have a good inflammatory response, so the wound and the surrounding skin might look completely normal with no inflammation, but just isn't showing progress as a high probability that it could be infected, because they don't have a good inflammatory response.

It's very important when we talk about the diabetic, so if somebody comes to you that has a diabetic ulcer as a diagnosis, diabetics are prone to two disease states. They are prone to arterial insufficiency and neuropathies. So if you have somebody with a diabetic ulcer, you need to find out if it's solely just neuropathy, that you're dealing with and do they still have a good blood supply with a better potential to heal or, do I have arterial and a neuropathy going on?

It's very important that you determine if it's just arterial or neuropathy or if you have a combination of both, because again how you proceed and the prognosis will be very different, depending on if there's a combination of both those diseases.

Here's a typical wound that we see. This is somebody who's got what we call 'Charcot's Disease'. You can see a very flat foot and how the bone structure is bowing out, so you can see the change in that whole bone structure. Unfortunately, this is someone who had a little tiny rock in their shoe and you can see how deep it is, you can see the muscle within that ulcer and it was a very difficult wound to get under control and ultimately led to amputation.

Here's another good example of why you don't let diabetics or people with peripheral neuropathy walk barefoot. The reason is because they can't sense heat. This is somebody who walked to their mailbox in the summer barefoot, came back to the house, walked around their kitchen and noticed bloody footprints in the kitchen and then looked at the bottom of their feet and this is what they found. The good news is at least they couldn't feel that pain. The bad news is that these wounds can infect and are very difficult to heal and will affect their ability to ambulate and things like that. It's hard to see in this picture, but that entire foot is very red and inflamed.

Now that we've talked about the lower extremity ulcers it's also important to differentiate a few commonly mistaken ulcerations for pressure. One is moisture or maceration of the skin. How you can tell or determine if a wound is from maceration or moisture versus pressure is if its moisture associated or maceration is that it will be over a large area, not defined to a single pressure point. It will be superficial as well.

If you look in this picture you can see it's over a large diffused area, very irregular wound edges, not associated with a single pressure point and very superficial. The problem with skin looking like this is that they are more prone to be effective pressure at this point. They can certainly develop a pressure ulcer within this area, but this would be considered macerated tissue or denuded tissue and would not be considered a pressure ulcer. How you treat it would be very different and you would not stage it.

Also, intertrigo...a lot of people mistake this as being a stage one or DTI because of the discoloration of the skin, but intertrigo is basically a fungal infection, so it's very important that it's properly diagnosed. The skin is going to be a very superficial kind of redness but it will have a bumpy appearance to it and if you see any satellite lesions, little red bumps that go out to the wound edges that's a good indication that this is a fungal infection versus an actual pressure ulcer.

Other wounds not caused by pressure, again it's very important that you don't diagnose them or stage them as skin tears, any dermatitis' or rashes of the skin, which will be over larger areas again not defined to a pressure point.

We do have some good resources for you if you want more information, especially at the WOCN Society has four separate pamphlets on all of these. They have one on pressure ulcers, one on arterial, one on venous and one on neuropathy that are excellent and great resources.

I hope you utilize this training session to help you identify that initial etiology, because that's the first and foremost most important thing when you assess an ulcer, because once you determine the etiology it's how you'll determine how you're going to treat those wounds.

Thank you for your participation.

**Kristi Wergin**

Thank you very much Jeri. This concludes our webinar. If there are any questions, please contact Stratis Health at [info@stratishealth.org](mailto:info@stratishealth.org).

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