Preventative Foot Care for People with Diabetes
Dr. Stephen Rith-Najarian

Well, welcome all, and I appreciate your patience. My name is Steve Rith-Najarian; I am a Family Doc from Cass Lake Indian Health Service here in Northern Minnesota and also the Area Diabetes Consultant for Bemidji Area.

And in the next 30 minutes what I would like to do is review a strategy for protecting the feet of people who have diabetes. We will cover three major topic areas; first, screening for high-risk patients; second, practical interventions that are available in the clinics that we serve; and then thirdly, how we integrate these practices into our own clinics.

To begin with, foot care is very important, because people with diabetes are at very high risk for foot complications and it's the leading major complication of diabetes, second only to cardiovascular disease.

Approximately 40% of people develop neuropathy, and on any given visit, if you remove the shoes of people, when they are in for the visit, inspect the feet, 20% of them will have an acute problem on any given time. 15% of people over the course of their lifetime will develop a foot ulcer, 5-10% progress to amputation, and approximately half of those who experience an amputation will die within five years.

Now, the good news is that most amputations can be prevented with resources commonly available in our primary care clinics.

To review some of the risk factors, these are the foot-related risk factors, including neuropathy, deformity, limited joint mobility, and that's sort of a stiff joint, prior ulceration or amputation, peripheral vascular disease, onychomycosis or fungal nails. Non-foot related risk factors include male gender, long duration diabetes advanced stage, and those that are modifiable include hyperglycemia, hypertension, dyslipidemia, tobacco use, poor vision, and especially other complications and particularly renal disease. Those who have end-stage renal disease on dialysis are at 10-20 times the risk of experiencing the amputation compared with those diabetics who are not on end-stage renal disease or dialysis.

Now, we have developed and pilot-tested simple criteria for identifying individuals who are likely to experience an ulcer in the future. And these criteria are: insensitivity to a 10-gram monofilament, foot deformity, prior ulceration or amputation, and an absent pulse or abnormal ABI as defined by an ABI less than 0.9. Now, if an individual has any one of these criteria, this will detect over 90% of the individuals who will experience an ulcer in the upcoming two years.

To perform a monofilament examination, the first step is to press the monofilament perpendicular to just the point of bending, hold for a second, and then release. I recommend first demonstrating on your own hand, because when a patient sees that for the first time, it looks like a sharp instrument. Then have the patient extend their hand and apply the monofilament so that they have a reference point for what normal should feel like and then proceed to testing the feet. Have the patient close the eyes and acknowledge yes, when they

feel the monofilament. You test four sites on each foot; the great toe, first, third, and fifth metatarsal heads.

If an individual cannot feel the monofilament in any one of those four areas in either feet, they are considered to be at high risk. The monofilament examination by itself is not 100%. In fact, recent studies have shown that the monofilament will detect up to 85% of people who have developed an ulcer. That means that it will miss about 15% of people. That's below the threshold of quality for a screening examination. Most screening examinations we expect it to detect 90% of the people. So it's just below that.

Accordingly, the American Diabetes Association this past year recommended that if a person can feel the monofilament then you should perform one other sensory test to increase the likelihood of picking up those who are at high risk. Now, we reviewed the literature on the five other methods for detecting sensory neuropathy and in our opinion, the 128 hertz tuning fork is probably the most cost-effective method. I mean there are better methods; Bio-Thesiometer, for example, but those are very expensive and the tuning fork is probably the most reasonable.

To perform this examination, what you do is you take the tuning fork, tap it against the ball of your hand until it starts to vibrate. Then apply it to one of the bones on the great toe, either the tip or on top of the joint.

Have the patient acknowledge yes when they feel the vibration stop and if they feel it stop before you feel it stop then that's an abnormal exam. A normal exam is when you feel it stop at the same time unless the examiner has neuropathy.

Now let's look a little bit about deformities. Deformities are very strong risk factors, because when you have altered biomechanics at the foot, you have abnormal pressures, abnormal pressures lead to repetitive trauma, and that outstrips the body's ability to heal.

Now, the foot is a very complex biomechanical mechanism and it is held in place by many forces applied by tendons and muscles. These muscles are controlled by nerves. So if you have nerve damage, it can weaken the muscle or cause atrophy that causes a shift in the forces that alter the shape of the foot. Here you can see how atrophy of some of the extensor in the muscles can lead to a shifting of the great toe laterally which creates bunion. When you have a bunion, it's sticking out and rubbing that can lead to what you can see here as a pre-ulcer.

Similarly, the toes have muscles between them called interosseous muscles, and when they atrophy, you get what looks like here is a claw-toe deformity or a hammer toe over here and here you can see pre-ulcers and a frank ulcer underneath that hammer toe.

Now the Charcot foot is probably the highest risk foot deformity. And it's caused by a constellation of neuropathy, deformity, and autonomic neuropathy that affects the blood flow of the microvasculature in such a way that when you have small trauma, let's say, a small little fracture in one of the bones in here, you get an exaggerated inflammatory response because of this abnormal circulation. The foot heats up, you start getting dissolution of the bones.

Then when it heals, it forms a large boney callus and you've lost the total architecture of the foot. Instead of having an arch, you have what's called a rocker bottom. That sticks out and can be the callus formation over here or a frank ulcer over there.

Now circulation; there are a number of tests including palpation of pulses, ABIs, and toe brachial indexes. In our opinion, probably the simplest is the dorsalis pedis and posterior tibial pulse palpation. These are the two main arteries in the foot. You have the posterior tibial that comes down here behind the ankle bone on the in-step and the dorsalis pedis on top.

The dorsalis pedis is the easiest to palpate. However, it is congenitally absent in and around 8-15% of the time. So if you can't palpate the dorsalis pedis, then you've got to sort of dig around for the posterior tibial, which is a little bit more difficult to palpate. Sometimes it's so deep that when you press deep, you can feel your own pulse. So you've got to sort that out.

Absent pulse in either foot confers high risk. So, those are the risk factors; neuropathy detected by the monofilament, deformity, and absent pulses. Those place people at high risk; any one of those findings.

Now, let's look at what the interventions we have available in our clinic to address these people. Now to begin with, to look at the interventions, we have to understand the causal pathways, because they form the basis of our prevention strategy. The most common casual pathway is when you have nerve damage plus deformity. So you have an insensate foot, a bone sticking out that gets pounded and if you combine to that repetitive injury, you get an ulcer. Then combined with that poor circulation and impaired infection fighting, it can lead to cellulitis, gangrene which leads to ulceration and amputation.

It's a little bit more complicated than that because it's never just one problem that causes it; it's always a series of things that occurred as we outlined in that previous slide. So it's not A or B or C, but it's A+B+C that leads to the ulcer.

And if you interrupt or remove any one of these then you can interrupt this cascade of events at least to the ulcer. So the strategy is to look at these various component causes like neuropathy, minor trauma, deformity, edema, callus, infection and ischemia that come up with a prevention strategy for each one of those, with the hope of preventing one or two of them and interrupting the cycle.

So we have the strategy for each one of them. So looking at neuropathy, we have good glycemic control and education of risk to protect the foot from injury that is the intervention for this.

For minor trauma, it's clearing up the walking space and protective footwear for deformity, footwear again, an education that goes along with that. Edema would be accommodated to stockings, diuretics, callus formation, podiatry care and so on.

Okay. Now self-management education is the cornerstone of most diabetic foot care prevention efforts. It's been associated with up to 50% reductions in amputations in a wide range of studies including the health settings.

And the educational objectives and content need to parallel your foot risk. So for those with low risk, the goal is to keep them at low risk by glucose control, blood pressure control, lipid control and smoking cessation for those who smoke; whereas for those who are at high risk, there are additional educational objectives.

For example, washing the feet and inspecting them daily; clearing the walking space of dangerous objects, appropriate footwear. We're going to go into this in more detail, footing selection, fitting and use. Avoiding barefoot, using slippers indoors, proper nail and callus care, and avoiding the bathroom surgery.

Avoiding extreme temperature is very, very important down in the Southwest, where temperatures can exceed 100 or up here in the Great Lakes region and Northern plains in Alaska where temperatures can get below 40.

Avoiding soaking; I'm going to go into that a little bit more because of the autonomic neuropathy and tendency to dry feet. And then lastly, reporting problems properly. Patients need to know who to call and when to call, especially regarding infections, ulcers and cuts that do not heal.

Now there are educational materials that outline of all of these objectives that have been pre-tested for comprehension and are available at the IHS Diabetes Program website, listed down here at the bottom of the page and you can download this PowerPoint at a link that will be provided to you.

The second component of prevention is footwear and it has been associated in people with diabetes with reduced plantar pressures, callus formation, reduced ulcer and amputation rates.

Let's go over a little bit of the anatomy of footwear. A shoe has an upper portion which is comprised a collar, back here, and you like to see this has some padding. An upper which has, in this case, an adjustable upper with laces, sometimes with Velcro, sometimes it’s with some elastic.

A toe box in the front which is where the toes are and you can add roominess, sometimes a half a centimeter or full centimeter to add depth for deformities. There is a counter, which is this heel portion and sometimes it would be a stiffening material in there and that provides lateral stability. An insert over here provide some cushioning as well as reducing friction by having a non-slip liner.

The sole should have a nominal lift and should be a little bit beveled at the heel and rockered in the toe, so that when you step off and get your heel strike it is more of a rocking motion rather than flexing the toe in areas which are susceptible to trauma and injury.

Okay now, in terms of footwear selection; patients who have normal feet, that is they are at low risk, can be advised they can wear standard shoes.

Those who have insensate feet should look at a quality walking shoe, or they can also wear extra-depth shoe because they would qualify for prescription. Again, those features are adjustable upper, a firm heel counter, padded insert with a collar, and a broad sole with nominal length.

Those who have insensate feet and minor deformities, you want to look at an added depth shoe with a custom molded innersole.

Major deformities need to have custom molded shoes and this would be people with Charcot feet or have had previous amputations or missing toes.

In terms of fitting footwear, patients should be counseled to select shoes that match the shape of their feet. Measure both feet while standing and also wear socks, fit the larger foot; most people have a foot that's a half size or full-size smaller than the other. And provide one centimeter of length between the longest toe and the tip of the shoe.

Breaking in shoes is very important. I can't stress this. I had a patient who loved his shoe so much that he mowed his lawn in them and then he went over and mowed his neighbor's lawn and three days later, he came back with a frank ulcer.

So when breaking them in, start with having the patient wear the shoe for half an hour and then increase in half hour increments each day, inspecting the feet for redness after wearing and they may need to stretch it out even further if they start noticing redness or hot spots.

I also advise patients to change their shoes daily because each pair of shoes provides a different set of stresses on the foot, and if you mix up the shoes and stresses are in different locations then it cuts those areas that are stressed to a shorter interval of exposure.

Always check for foreign bodies and replace the shoes when they are worn out. Now again, there are educational materials that re-enforced all of these principles and can augment your education experience and these are available at the IHS Diabetes Program homepage at the link below.

Okay. For those who have Medicare Part B, there is a therapeutic footwear benefit and its three steps. First, you have to have a physician certification. This certification criteria are the same as our high-risk criteria.

Second, you need to write a prescription, and this usually is done by a podiatrist. And then thirdly, the shoes have got to be fitted and dispensed, and this is usually a pedorthist. These need to be three separate people, and there are forms that are available that can guide you through this process.

Okay. Now the last component of prevention in primary care settings is routine podiatry care, and podiatry care has been associated with increased knowledge, reductions in ulcerations and amputations.

There are three components to palliative podiatry care: lubricating the skin to reduce friction and cracking, trimming of nails, and reducing calluses. I mentioned that people with diabetes and who are at high risk have neuropathy and they often have a tendon autonomic neuropathy which impairs the function of the sweat glands.

Early on, they actually get increased sweating and that's not a real risk but once they get decreased sweating at later stages, the feet are prone to get dried out and cracked and this puts them at risk for infections.

This can be reduced by applying an emollient lotion, or a moisturizing lotion and whether or not you use an oil-based or water-based that's really up to the provider and patient preference. And put it on liberally, rub it in and then wipe off any excess, especially between the toes, so that you won't get maceration. Some patients may need to have assistance in applying this by a caregiver.

Nail trimming is something that patients need to also receive instruction, and sometimes it's best provided by a skill provider, especially for patients with poor eyesight. To trim nails, you need to have good lighting and comfortable place to sit, safety glasses because those nails will fly. Whether or not you use a curved or straight nail nippers that's really a matter of preference. The basic technique is to stabilize the toe with one hand and then take the nail nipper and start at one edge and move across to the other edge and follow the curve of the nail if they have normal nails.

And if there're any sharp edges, file them down with an emery board. Trimming curved nails or horn nails is very similar technique, but instead of following the curve of the nails, keep it a little bit longer than the nail bed, so that you don't get an ingrown nail and start at one edge and go across straight. Again, file any sharp edges with an emery board.

Now, those thick mycotic nails, sometimes you can nip away with those with a nail nipper, but they tend to break off in fragment, and other times, you can use a dremel and just basically sand them down but you have got to be real careful; you don't get down too deep. Safety glasses, and even a mask are imperative in this case; you have to have good ventilation in the room. My advice is that unless you have experience of this; refer this to a podiatrist or someone like a Certified Foot Care Nurse who has got specialized training in this.

Now, callus care is very important and probably the most important thing is prevention. Calluses are a result of friction, and so if a person has a callus, take a look at their footwear, see if there is a seam in there, see if it's occurring over a seam in a sock or a worn out area in the shoe. Second of all, if they do have the callus, then it needs to be debrided because having that inside the shoe is like walking with a stone inside the shoe.

To get debride a callus, you need to have good lighting, gloves, alcohol swab, disposable number 15 blade, and you should probably also have a material for ulcer management such as saline, 2×2s, 4×4s, and gauze wrapping tape because sometimes if you debride a callus you un-roof an ulcer.

Now, the basic technique is to start by wiping this with alcohol. What will happen is, that alcohol will turn callus tissue white and it will demarcate where the callus is from the healthy skin which will remain a pinkish shine. And then you palpate to reinforce where the callus is, and then begin at the center, holding the scalpel like a pencil with short strokes, shaving off smaller bits of the callus, moving towards the periphery, palpating intermittently to feel when you're starting to get towards the normal pliable tissue and that's your signal to stop.

Now, to summarize, what we recommend in our best practice is to have providers remove the shoes at every visit. This is something that you should probably just incorporate when doing your vital sign; remove the shoes and put them on one of those blue chucks on the floor.

Then if there is no acute deformity or no acute problem or ulcer, perform an annual examination of the foot if it's due; testing with the monofilament, inspecting for foot deformity or asking for prior ulcer and amputation. If they have none of those, they're at no risk, and then go over the education principles that reinforce controlling blood pressure, blood glucose, lipids, and smoking sensation if they smoke, with annual follow-up.

If on the other hand, they are at high risk that is they have some abnormality on this examination, then you need to do more intensive education on these principles reviewed; provide protective footwear, routine podiatry care, plus all of these measures as well. We follow up every two to three months and sometimes even monthly if they have got some of these recurrent calluses that come back very frequently.

Now, we didn't go into ulcer management because it really is beyond the scope of this and I am not going to spend a lot of time on this because of the shortness of time. But I do just want to highlight that there are high and low risk ulcers and complicated ulcers. Uncomplicated ulcers are small without extensive protection and these can be managed as an outpatient whereas complex ulcers are large with deep space infection, and these should be managed by a wound specialist.

Now, let's take a look at some of the strategies for implementing this into our practice. Many of you will recognize this as the Chronic Care Model and the best practice for foot care incorporates a lot of these features including self-management support delivery system design such as foot care team's decision support, putting guidelines, information systems such as registries and tracking systems. But it's very important to have your leadership on board to support all of this to happen and to link to resources in the community that you may not have available in your clinic and with that, you can expect to improve the outcomes.

Now, the foot care team is one of the key things to improving care and the team should be comprised of your primary care providers, your nurses and educators, those who do your scheduling, your consultants and field help and like I mentioned, having your leadership onboard with input from your patient.

So the first thing that you really need to decide is what kind of foot care program do you have. Is it going to be a basic program that looks mostly screening at education? Are you going to have an intermediate program where you look at adding podiatry and footwear services or is it going to be a comprehensive program that includes wound healing and outreach services?

Then you have to look at guidelines and these guidelines need to be customized by your team so that they are appropriate for your team. You have to delineate roles; who is going to do what, where is it going to be documented, and what are you going to use for monitoring. You can consider the Model for Improvement or rapid PDSA cycles - Plan Do Study Act - as a tool for implementation and what this does is test small scale change and then ramps it up.

Here is an example of a clinic locally which had low foot exam documentation rate of 25% and they wanted to increase it up to 90%. They made a prediction that if they had their Certified

Nurse Assistant perform the foot exam, it would increase documentation rates. So, they were going to have the CNA do the foot exam when they put the patient in the room to get the vital signs and chief complaint.

So the first cycle -- they broke this down into a series of steps. The first cycle was to see if the training could be effective with the CNA and it was. The next step was to have the CNA perform the examination on three patients and that went fine. Then they ramped up to having the CNA do it on all the patients in that provider for the day and what they found is that the monofilaments weren't in all the rooms. So they had to be running back-and-forth. So then on the next cycle, they put monofilaments in all the rooms.

Then when they did that, they found out that the provider wasn't always picking up as to whether or not the monofilament exam was done because it's documented on the Wellness tab, and once the provider gets into his EHR template, you can't leave the template without losing your template. So they are now currently looking on trying to develop links between the Wellness tab and the progress notes so that it gets populated.

Here's an example of some paper chart reminders and templates; here's an EHR, they are under the Reminder tab. You can see foot exams; if it's not listed on the Wellness tab as Foot Exam Complete, it will pop up. And here is an example of a Foot Care Exam template which is in one of our routine clinics templates and you just click Diabetic Foot Exam and this pops up.

Just a reminder that the foot exam is documented under the Wellness tab and exams. So for wellness exams, click Add, select Foot Exam, and then this window will pop up, putting your results and any comments, and then click Add.

Education is the same deal; it's listed under Wellness, Education, and then type-in Diabetes, and then you'll get a whole list of things. You can select the Foot Care 1, you can right-click, and get a list of all the education objectives, and then put in what you covered in your exam.

Registries are very important for tracking patients at high risk and there is the RPMS registry which we encourage all people who use RPMS to use, and iCare can be a very valuable tool for tracking. It is a population based management tool that allows you to look at health factors in a particular group of people. Here's a list of some of my patients who have been seen in the past year, and then the beauty of this is that you can organize it in such a way that you put all of the health factors you want to follow, and then if you like click on Foot Exams, for example, it will sort it by whether or not they've had it done or not.

So this is the list of people who I have seen in the past who haven't had a foot exam and have diabetes and then I can target these folks for exam. Or you can do this, organize this by who is coming into clinic for that day, and be prepared for the clinic.

Case managers can be valuable. This is Charmaine Branchaud on the left. She has been a Case Manager for Diabetic Foot Care at Red Lake since 1995 and recently with the Innovations in Planned Care Initiative, has taken on another role, and hand over the baton over to Emily on the right. Charmaine got her training by shadowing a contract podiatrist that came up once a month and after about four sessions with the podiatrist and doing things under his supervision, she was able to do routine nail and callus care.

Then after about shadowing him for another year was able to expand to do wound care. Emily got her training by shadowing Charmaine and then also going to a training course that was held over in Eau Claire, Wisconsin, but you can get these training courses everywhere. There are links on our website to the LEAP Program which is the HRSA website for training and it's a very valuable training.

And this training can lead to eligibility to sit for certification exam for foot and nail care through the Wound, Ostomy and Continence Nurses Certification Board.

And then lastly, you want to look at outreach. This is Craig Walvatne on the left. Craig is a vascular surgeon who comes from Minneapolis up to one of our clinics up in the Northwoods here, in Northern Minnesota and provides consultation services on a monthly basis and it really works out well because he can identify people who are need of vascular serving before it gets too late and get them on down from vascularization or provide more intensive wound management locally without having to get folks down in the cities which is a real challenge. Remember, we are telling these people to be non-weight bearing and then we tell them to get to travel 200 miles to a clinic and it puts them at some risks.

And then pedorthic services are another thing that you can provide at outreach and lastly, public health nursing and CHRs can be instrumental in following up with wound care as well as tracking people who were lost to follow-up.