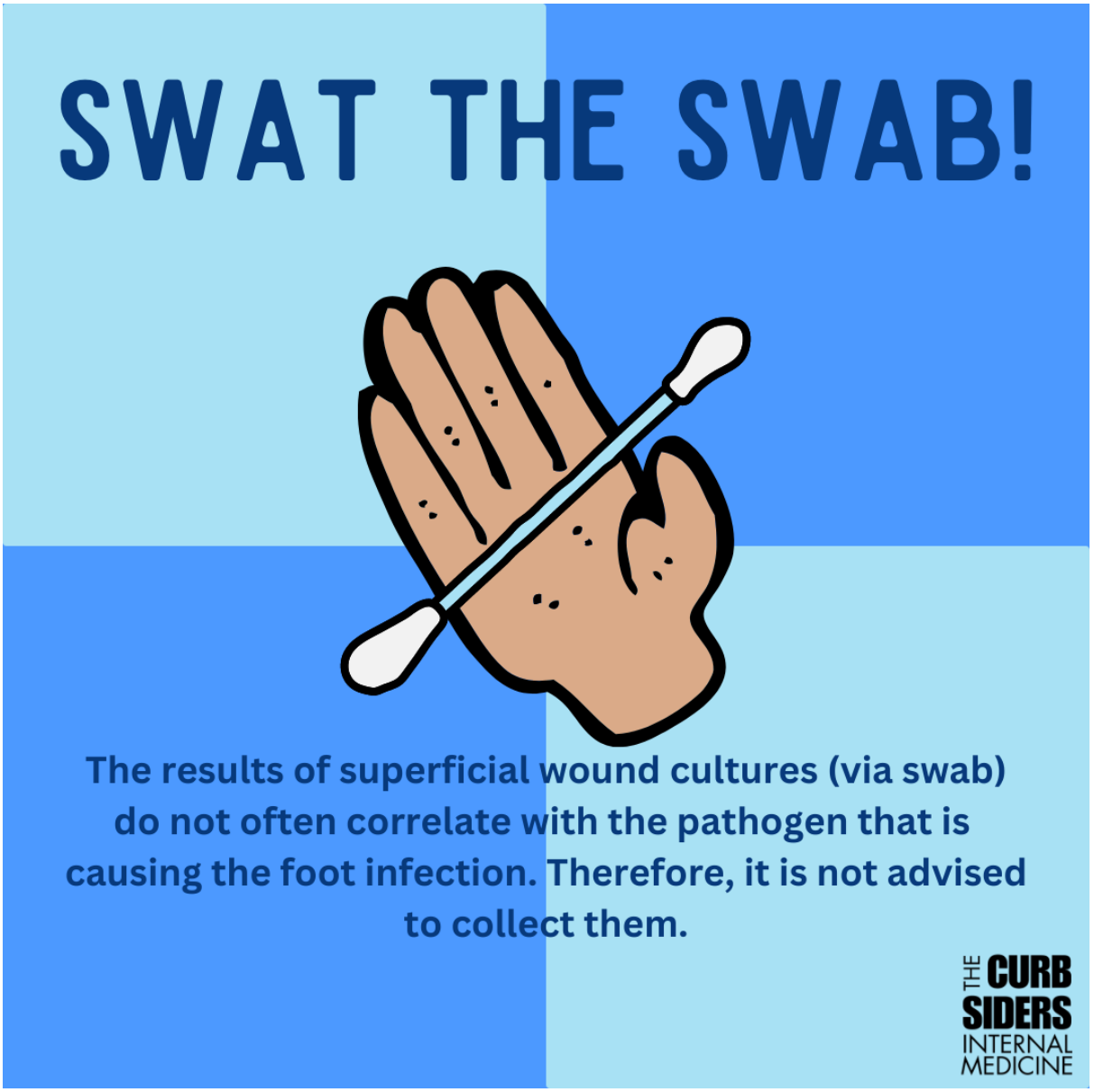
#410 Diabetic Foot Infections

A Guide to Seeing Them and Stopping Them in Their Tracks



RJ: Monee and Meredith, I think it's really time as a new producer to really get my feet wet as a producer. So, let's do this.

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[Disclaimer]

[The Curbsiders theme]

Monee Amin: Welcome back to Curbsiders, another inpatient episode. I am Dr. Monee Amin, joined by my effervescent cohost, Dr. Meredith Trubitt. How are you this evening?

Meredith: Doing pretty well, Monee. How about yourself?

Monee: You know, I'm living the dream and everyone's going to find out why soon.

Meredith: Mm-hmm

Monee: On tonight's episode, we discussed diabetic foot infections with the great Dr. Andrew Webster. In just a minute, our new producer, Dr. RJ Blackburn, will tell you a little bit more about our guest and himself and the topic. But first, Meredith, will you remind the audience what it is we do on this show?

Meredith: Sure Monee, I'd love to. We are The Internal Medicine podcast. We use expert interviews to bring you clinical pearls and practice-changing knowledge. As you already mentioned, we have our new guest producer, RJ Blackburn. So, RJ why don't you introduce yourself and then you can tell us a little bit more about our guest tonight, Dr. Webster.

RJ: Absolutely. Thank you all for having me, Monee and Meredith. So, I am an internal medicine physician at Lake Cumberland Regional Hospital in Somerset, Kentucky right now, and I'm the Associate Program Director for their freestanding Rural Internal Medicine Residency. I'm interested in all thing's tech, 3D printing, just pretty much technology nerd. So, love that and love the Curbsiders. So, I'm fangirling that I get to be on an episode right now, so it's pretty awesome. We have a fantastic conversation with our guest tonight, Dr. Andrew Webster. He is an infectious disease physician at the Atlanta VA Medical Center, where he serves as the Director of Antimicrobial Stewardship Program. He completed his Infectious Disease And Medical Microbiology Fellowships at Emory and has particular interests in medical education and diagnostic stewardship. On tonight's show, he teaches us a comprehensive approach to the diabetic foot infection with a focus on diagnostic workup and antibiotic therapy, learning who really needs that MRI, and when to call your surgical colleagues, and who exactly needs the Pseudomonas and anaerobic coverage anyway.

Monee: A reminder that this and most episodes will be available for free CME credit for all healthcare professionals through VCU Health at *curbsiders.vcuhealth.org.*

RJ: So, without further ado, let's get into it.

Monee: Andrew, thanks for coming on the show. We're super pumped to have you here. And we're just going to start with some rapid-fire questions so everyone can get to know you a little better. Can you start with a bit of a one liner?

Andrew: Yeah, sure. Thanks for having me. Very happy to be here. So, I am 36 years old. I'm an infectious disease physician and board-certified microbiology nerd whose love of all

things ID and trivia related are eclipsed only by my family, which includes two spastastic children aged six and three. Then I also have a borderline pathologic love for baseball.

Meredith: And it's baseball season.

Andrew: It is. My team is the Texas Rangers and we're off to one of our best starts in history. It's been very exciting to watch despite the loss of our big free agent pitcher acquisition. So, a lot of baseball watching so far

Meredith: Andrew, we have to talk about this offline. I'm a Rangers fan too, so I'm-

Andrew: Texas connection.

Meredith: -actually going home this weekend and then we're going to the game. [laughs]

Andrew: Ah, so exciting.

Monee: I was going to say you're speaking her love language right now for baseball.

Andrew: There we go.

Meredith: Yeah**.**

Andrew: I don't know how we don't know this.

Meredith: [laughs] I don't know either. I'm like really shocked.

Monee: Yeah, she's really worried about Texas.

Andrew: I think it's because I went to Texas A&M and I've seen you in UT gear, and so I may have just-- [crosstalk]

Meredith: We probably just don't address it.

Andrew: Yeah.

Meredith: Yeah, that feels right. Okay, any books, movies or anything else that you would recommend for people?

Andrew: Yeah, so I just finished two books actually. So, one, a nonfiction book was actually called *The Baseball 100* by Joe Posnanski, who's one of my favorite sports writer, who makes an arbitrary list of the greatest 100 baseball players. It's basically nothing but baseball trivia, which was amazing and fun to read, but probably not for everybody. My most recent fiction book I read was actually *Project Hail Mary* by Andy Weir, who's the same author who wrote *The Martian*, and it's in a similar vein of hard science fiction, but it was a pretty incredible book. I'm actually rereading it for the third time right now and it is making its way into my top five books of all time. So, I definitely recommend that for any science fiction fans out there.

Monee: Awesome. Yeah. Joe Posnanski who wrote for the Kansas City Star when I was growing up in Kansas City. One of my favorite sports writers there wrote some of my favorite articles I've ever read about coach Bill Self, actually, but anyway. Meredith, shall we do some picks of the week?

Meredith: We should. Maybe you should go first.

Monee: So, this is going to air much later than this happened, so it'll be old news for everyone except me still. So, as some of you may know, the new Kelly Clarkson album came out on June 23. It's called *Chemistry*, and she was going to be putting out-- she did an album signing in New York. So, I, of course, as a dedicated fan and also it being my birthday was going to be there for that. So, I won't get into too many of the details of how this happened, but a friend of mine who is also a Kelly Clarkson fan, lives in New York and has some connections at the record label, and she got me into a pre-album release party that involved Kelly Clarkson. I thought it was just she was going to show up, do a little toast, blessing her album, homegirl did karaoke with the fans for an hour and a half, and I did karaoke with Kelly Clarkson to Stronger, which is in my top five Kelly Clarkson songs of all time. So, yeah, that's my pick of the week Meredith [laughs].

Meredith: Yeah, if anyone wants to know what whiplash looks like, it's seeing Monee come back to work after having just done that the weekend before. [laughs]

Monee: I was pretty sad. I was pretty sad. But I was really glad to be back around my friends because I did miss the VA crew, at least my friends, so. But Meredith, what's your pick of the week? I know you've been holding on to this one for a hot minute.

Meredith: Yeah. I just wanted you to go because mine's also sports related and so I wasn't sure if it was two sports topics with Andrew, but my father-in-law recommended this book, so shout out to Doug. But it's called *Loving Sports When They Don't Love You Back*. And essentially each chapter talks about different ethical conundrums that you deal with, that sports deal with. So, when the mascot is racist, how do you rationalize through that or different things like that? And each chapter goes through something else and the history of it and all of these things. The book speaks to me, but I know it's also going to speak to Monee because we often have these conversations also. [laughs] So, it's a great book. It's not like super long or heavy, but it just weighs how do people rationalize through that and what's the psychology of it and all those things. So, highly recommend. It's been really good so far.

Monee: I like it. RJ not to put you on the spot, do you have a pick of the week? If you don't, that's fine. That's totally fine.

RJ: Yeah, definitely nothing as cool as you all. I've not been to any Kelly Clarkson parties and singing karaoke with Kelly Clarkson, [laughs] but I feel like a nerd. I also haven't been reading either, but I've been really big into 3D printing recently. But I don't think that's good enough for pick of the week. So, we can-- [crosstalk]

Monee: No. What's your most recent 3D print?

RJ: Yeah. I live in a rural area, so I had a neighbor come up and say, “Hey, this 50-year-old tractor I have, the knob on it broke and no one has a replacement part for it. So, can you reverse engineer it for me?” And it was pretty awesome and even customized it with a logo for his particular brand of tractor and got it to him and he was super happy about it.

Monee: Oh, man.

RJ: Felt pretty good.

Monee: RJ, this has given me some throwback star-like late night conversations on night float as interns about whatever techie stuff you were up to. So, good to know that things have not changed.

RJ: No, it literally is a pick of the week for me. This week it's 3D printing. Next week, it'll be something else tech, but obviously not GarageBand or anything audio related of course.

Monee: [laughs] And with that, RJ can you please take us to our first case from Kashlak.

RJ: Absolutely, Monee. So, we have a case from Kashlak Memorial. The patient, Oliver Footington, is a 65-year-old male with type 2 diabetes mellitus. He's had diabetes for 20 years and has been poorly controlled for most of that time. He is overweight and has a history of hypertension, hyperlipidemia, and coronary artery disease. He smokes approximately one pack of cigarettes per day for about 30 years. He presents to the emergency department with a two-week history of pain and swelling in his right foot and the development of a wound. He reports that the pain is worse when he walks and that he has been unable to put weight on that foot. He also reports that the area around the wound is red, warm, and tender.

On physical exam, the patient has a 2 cm ulcer on the plantar surface of his right foot. The ulcer is deep and has purulent drainage. There is surrounding erythema, warmth, and tenderness. His vital signs are stable and his white blood cell count is 12,000. The emergency department obtained an x-ray of the patient's right foot that shows no evidence of bone involvement. All right, so, Andrew, I guess our first question obviously is, does this case represent a typical scenario that you might encounter for a patient presenting with a diabetic foot infection?

Andrew: Definitely. This absolutely sounds like a typical case for a diabetic foot infection or DFI and it sounds like a relatively straightforward definition, but I think really when someone says diabetic foot infection it to me paints a little bit of a different picture. So, infection obviously meaning usually the cardinal signs of inflammation when you're dealing with soft tissue infection. So, things like redness, warmth, tenderness, swelling, of which Mr. Footington had multiple and for a diabetic foot infection, those signs of infection occur in association with some soft tissue defect or injury. I think classically we think of the diabetic foot ulcer, which is probably the most common skin breakdown that you'll encounter with a diabetic foot infection. But these infections can also occur in the setting of trauma.

So, I think we've probably all had a diabetic patient who develops a callus and takes into his own hands, and people get very creative with how they deal with these things on their own. So, there could also be this element of trauma which then leads to infection. But really, I think about it is its association of a soft tissue injury with signs of infection below the ankle in a person with diabetes. That's how I would think of it. So, in Mr. Footington's case, he has all those features for us to call it a diabetic foot infection. We also get some clues about some risk factors for diabetic foot infection as well you know. He has hypertension, hyperlipidemia, coronary artery disease, so he may have some other vascular disease. He's a 30-pack year history smoker, so he definitely has the right risk factors. He's definitely presenting with the right clinical scenario. So, this is very typical for what we would see.

Meredith: So, you're just talking about some of the risk factors that he may have. How do you risk stratify or consider kind of like classify the severity of the infection for these patients?

Andrew: Yeah, it's a good question and I do think it's important to classify the wounds and do so consistently. There was historically a lot of different definitions in terms of risk stratifying or classifying these diabetic foot infections. But thankfully, most of the new guidelines have a consensus definition that's very similar regardless of which guidelines you're looking at. So, the IDSA guidelines, The International Working Group for the Diabetic Foot, a lot of other scoring systems, all incorporate the same features. So, when you're trying to classify a diabetic foot infection, there's usually four different points on the scale.

So, the lowest one would be no infection, and then you have mild infections, which are typically confined to the superficial soft tissues and then also less than 2 cm of erythema from the edge of the wound. So, in other words, relatively mild inflammation associated with the wound. Moderate infection would be an infection that extends either greater than 2 cm from the wound edge or involves deeper structures, which can include bone.

And then, the marker of a severe infection would be essentially signs of sepsis or signs of systemic inflammation, which for definitions of diabetic foot, I still rely on the SIRS criteria. So, are they tachycardic? Are they tachypneic? Do they have fever? Or do they have significant leukocytosis? So, for Mr. Footington, we don't have a specific measurement per se of the amount of erythema, but we know it's a relatively large 2 cm ulcer. It's described as deep with purulent infection. So, I think we could probably pretty safely say that this would be a moderate infection. I think you could start to argue a little bit with that white count of 12,000 that is, he's starting to get towards severe, but with normal vital signs, I think I would classify this as a moderate foot infection. And that's important because that has implications for how you would manage it.

Meredith: And thinking about other physical exam findings, is it all localized to the wound itself and vital signs, or is there anything else that you would be looking for for him?

Monee: Like, i.e., should I be bringing out the monofilament during this situation?

[laughs]

Andrew: Yeah, so I think things like diabetic neuropathy and peripheral arterial disease are commonly going to be present in someone with a diabetic foot infection. So, I mean, it's important to note those, but those are generally going to be present, particularly neuropathy. Peripheral arterial disease may be present in slightly less than half of people presenting with diabetic foot infection, but neuropathy is going to be a very common feature, and so you can risk stratify a little bit by the severity of those findings, particularly the presence of peripheral arterial disease. So, if they have clinical signs that are concerning for lower perfusion, that increases the risk of developing a more significant infection or having an infection, which may lead to a more morbid outcome, such as amputation.

Meredith: I think on the physical exam also on previous episodes where we talked a little bit about diabetic feet, although it's been several years since that episode, one of the exam findings was for the at-risk diabetic foot, like having bounding pulses and things like that. Can we just maybe differentiate if you're still looking for some of those physical exam findings or once they're already hospitalized in this more moderate-to-severe infection, are those exam findings still as useful to you?

Andrew: Yeah, so I actually went back and did listen to that episode, which is a great episode. And certainly, for those of you who are listening to this episode, if you haven't listened to the old episode on the examination of the diabetic foot, it's certainly worth a listen in terms of assessing the high-risk diabetic foot. I think once someone is presenting clinically, like Mr. Footington is, which looks like a moderate severity diabetic foot infection, using some of the features that might identify an at-risk foot is a little bit of a moot point because he's no longer at risk. He actually has the complication that we were worried about in trying to identify risk factors for earlier. So, I think the main one that I'm concerned about, again, neuropathy is going to be a common finding. You can confirm that, but a lot of people are going to have it.

Mr. Footington still has pain, so maybe his neuropathy isn't significant. But the thing that I would be most concerned about in terms of assessing would be the vascular supply.

Monee: For the listeners, it is episode 42 since we've mentioned it a couple of times. Before we get to my real next question. One of the things struck me in the guidelines was that they said that up to half of the patients don't actually have some of those cardinal symptoms or signs of infection. So, I was hoping you could maybe talk us through how to parse through somebody coming in, say, “This looked a little different, it was a little smaller, his white count was normal.” How do you approach somebody where you're like, they have diabetes and they've got something gnarly on their foot, but it doesn't quite exactly look like I'd expect. How do you go through that?

Andrew: Yeah, so it can be challenging because some of those same factors which we just discussed can impact those cardinal signs of inflammation that we discussed earlier. So, if someone has significant neuropathy, they may not have any pain and so they may not say, no, I have no tenderness associated with this wound or if they have a decreased vascular supply, you may not get that redness and erythema that you're used to seeing because there's decreased blood flow. So, you can't always rely on all of them. I think if you have a couple of them, that's always concerning. But there are other physical exam findings you can also use to assess whether the ulcer is particularly in the setting of diabetic foot ulcer if the ulcer is at risk.

So, ulcers which have been present for a long time, so usually that's defined as like 30 days would be concerning for infection. Ulcers that aren't healing despite receipt of appropriate wound care would be concerning for possible infection. So, those aren't as reliable. There are other things which can lead to more chronic or nonhealing ulcers, but those would also be red flags in terms of concern for infection.

Monee: Maybe even somewhat along those lines so, Mr. Footington came in, got an x-ray, didn't show any bony involvement. I just feel like I'm always being told by somebody to get an MRI. [chuckles] So, is this something that is rooted in some evidence or is this some old thing that just keeps getting passed down? I'm asking for permission to stop ordering them, but I have a feeling that's not going to happen.

Andrew: Yeah. [laughs] So, you've probably been told by many different specialties to order an MRI while caring for a diabetic foot. I'm sure we in ID at Kashlak have told you to order this MRI. I'm sure some of your surgical colleagues have told you to order an MRI and so I mean there is a reason behind it, so there is rationale for why we recommend it. So, an MRI really is useful when you're trying to determine whether or not someone has osteomyelitis and maybe the clinical features or lab markers or other things you might be using to try to distinguish whether or not someone has osteomyelitis are equivocal. In particular, the x-ray, it can be very specific, if you see findings of osteomyelitis on plain film. The findings on x-ray lag behind the clinical exam by really a couple weeks. I think the traditional teaching is about two weeks at least, although some would say even longer.

So, the fact that Mr. Footington has a negative x-ray right now at the time he's presenting for his infection and really symptoms have only been present for two weeks, it might be a little bit early to detect osteomyelitis, even if it's now actually there at the base of his ulcer if his infection has progressed to that. So, if you can't use that x-ray, that one-time single x-ray to rule out osteomyelitis and your other tools for assessment are equivocal, then that's when you might go ahead and look for the MRI. Serial x-rays can be helpful, again, because if you're doing them every few weeks, you can look for those bony changes and that can be a helpful longitudinal assessment. But when you're in the hospital and you're admitting someone who's presenting for the first time with a wound and they have an x- ray, that's normal, that doesn’t necessarily rule out osteomyelitis. So, from an infectious disease standpoint, that's often when we'll start looking for that MRI is trying to determine whether or not there's bony involvement, because that's something that will definitely impact management.

Monee: With the MRI sensitivity/specificity in the workup space, inflammatory markers, ESR, CRP, I feel like sometimes I've been told before even thinking about the MRI, you should maybe look at those. Are they relevant? How do I use those if I'm getting them?

Andrew: Yeah. So, there were a few other markers that you can use for osteomyelitis that are commonly used, and there's three in the initial, not super expensive, noninvasive assessment. So, x- ray being one of them, but we just talked about the limitation of the x-ray. So, the other would be a probe-to-bone test. Now, that really relies on the experience of the performing practitioner. So, if the person who's doing the test doesn't really know what they're doing and they don't have a lot of experience interpreting those, then that can be problematic to interpret. But you essentially insert a blunt tipped metal probe into the wound, and if you feel a hard, gritty surface that's bone, then that's considered a positive probe-to-bone test. That's often considered diagnostic of osteomyelitis by itself. And then when you look at other factors like the inflammatory markers that you mentioned, there is a systematic review that was done a few years back which said that an ESR greater than 70 had a sensitivity and specificity in the 80s for detecting osteomyelitis.

There have been other studies looking at things like procalcitonin or C-reactive protein. All these are acute phase reactant markers of inflammation and I think they do have their use. But is someone with an ESR, for example, of 50, do they definitely not have osteomyelitis? No. Is everyone with an ESR greater than 70, do they have osteomyelitis? No. So, it can be part of the picture. So, if there were some questionable changes on x-ray and the ESR was 100 and the probe-to-bone was positive well, sure, in that situation maybe you don't need to go to the MRI to confirm osteomyelitis, because all of your other noninvasive tests are confirming that diagnosis. But it's usually not that black and white and so usually all those tests are equivocal or not diagnostic. So, then you can move on to the MRI for that purpose.

Monee: I think we're ready to advance the case. RJ would you mind doing that for us?

RJ: Absolutely. So, you are called by the nurse when Mr. Footington finally arrives to the floor. The nurse tells you that on their assessment, the dorsalis pedis pulse is more difficult to appreciate on the right than on the left. The nurse also asks you if you want to swab the purulence from the wound. So, do you recommend all patients that present with diabetic foot infections undergo vascular evaluation?

Andrew: Yeah, and I think that's really important. I think maybe something that's a little bit underappreciated. I think that undergoing a vascular evaluation is such a critical step in managing patients with diabetic foot infections. I think most people probably do like a basic bedside evaluation. They'll palpate for the pulses and say whether the pulses are present or not. Some people may document things like foot temperature, but really, the clinical exam, looking at things like capillary refill or presence of pulses, that's really not enough to rule out significant peripheral arterial disease. So, you can't really just use some of those bedside findings to say, “Yes, the blood flow is good.” We don't need to do anything to intervene and improve or anything to act on this potential peripheral arterial disease. I still think that's a worthwhile thing to do. I think that's the minimum that you need to do is a focused clinical exam.

Asking in terms of history, do they have a history of claudication? How long has the wound been there? Is this a chronic nonhealing wound, which as we mentioned early could be a sign of infection, but could also be a sign of poor perfusion. Look for comorbid conditions like Mr. Footington, his 30-pack-year smoking history, his hypertension, his hyperlipidemia, his coronary artery disease. Those should all raise red flags for the possibility of significant peripheral arterial disease. You can also examine the wound and look for signs of ischemia. So, is this someone who has gangrene that would obviously be very concerning for poor

perfusion. Just to know again, neuropathy can mask signs of claudication and again, peripheral arterial disease can be present even in the presence of pulses. So, it's important to do that initial clinical exam, but I wouldn't rely on that as far as excluding actionable peripheral or arterial disease.

So, that's why I think it's important that when you're seeing these patients, you really go to that next step. I understand that some people may be at institutions or maybe practicing in settings where it's not practical to get these things on every patient. So, I think the bare minimum is what we just discussed. But I think ideally, you go the step further and you go to the noninvasive vascular interventions and that they're often done in the vascular lab, so doing things like ankle systolic pressure and ABIs, that's probably the one that's most commonly known, although you have to be very careful with ABIs because particularly in diabetics, you can get calcification of the arteries in the ankle, which can lead to falsely elevated readings. So, someone with a normal ABI may still have significant peripheral arterial disease.

So, there are other measurements that are often done which can help try to sort out the perfusion status of the foot. So, there's something called toe pressure, which is done in a similar manner. You can get a toe pressure index. Then there's also something called transcutaneous oximetry. We are actually measuring like the oxygen tension in the tissue, which can give you a sense of perfusion. So, those are the things that I think ideally would be done in every patient. But again, you may be limited by your practice setting. So, if you don't have ready access to that or ready access to specialists, then I think at minimum going through some of those historical and clinical features we just discussed.

Meredith: Yeah, I think that's the best way to put it because I know sometimes when I'm examining the patient, whoever it is, I almost feel like I'm doing their full neurovascular foot exam. I sometimes feel like I'm trying to convince myself that they had good pulses or good cap refill. But in reality, I think if you're really having to convince yourself, like you said, that's probably the right patient to be asking for the further evaluation on.

Andrew: No, I 100% agree. So, if there's any uncertainty whatsoever in your mind, then you need to be taking that next step evaluation because, again, people with completely truly normal exams may still have significant peripheral arterial disease. The only way you're really going to know is by taking those next steps and doing some of those noninvasive vascular studies.

Meredith: So, when you do get those tests back, how does that guide your conversation with the patient? Because often I feel the tests end up being positive or something. So, it changes the management or prognosis for the patient.

Andrew: Yeah. So vascular supply is one of the really important factors, obviously, like we just discussed, when you're dealing with diabetic foot infections. And so even as an ID doctor, I think it does impact my discussion. Obviously, based on the results, if there's something that's significantly abnormal and our vascular surgeon colleagues are consulted and they'll plan the next steps for things like, “Do they need a CTA with runoff and do they have good targets for revascularization? What's the likelihood that it helps?” So, those things can help with those discussions. But even from an ID standpoint, ischemia is one of the things that really can be predictive of poor outcomes. So, I know we talked a little bit earlier about some of the infection classifications and how we classify them as mild or moderate or severe. So, there's one scoring system in particular called the WIfI scoring system, which I like because it's an easy to remember mnemonic, but it stands for wound, ischemia, and foot infection.

There're various factors, we already talked about the schema for how they look at foot infection. In Ischemia, they basically use the results of those non-invasive vascular studies which we just discussed and in use of that WIfI scoring system. So, combining the type of wound, the degree of foot infection, and the degree of Ischemia based on those studies can actually help predict who would benefit from a revascularization procedure as well as who's at higher risk for amputation. So, how I use that information, I let the surgeons do their thing for working up the vascular disease and talking to them about revascularization if that's an option. But how I would use that information would be to just tell the patient, “Hey, there are some concerns with the blood supply.” Blood supply is really important for healing these infections. It's how the antibiotics get to the wound. It's how the antibiotics work.

So, I am concerned that there seems to be poor blood flow and this sometimes could be predictive of a more serious complication and set the stage for them that this is likely something where they're going to need some debridement, they might need revascularization, they're at higher risk for amputation. And if nothing else, just to be honest with the patient about your concerns. I think that also helps to them kind of clarify the severity of what they're dealing with, because I think we've all probably had some patients who are a little bit surprisingly nonchalant about some of these things, and that can often drive home the point that this is something serious that we need to be concerned about.

Monee: Yeah, I think that conversation is always hard to have, especially as someone that doesn't do any of the intervention piece. So, it's helpful to have a framework to have those conversations. I think the last chunk of this before we recap what we're doing is the piece of you get called, asked, they got swab in hand and asking you, “Hey, I'm really pumped, I want to swab this.” Should I say go ahead or should I swat it from their hand? Swatting is not nice, but you know what I mean.

Andrew: I understand. As a microbiologist, I applaud your instinct to swat away the swabs. [chuckles] In reality, swabs have a lot of limitations. But when you're looking at these foot infections, most of the time, unless it's like a traumatic wound followed shortly thereafter by infection, but most of the time these are more chronic wounds that then become infected when you look at the development of the diabetic foot infection. So, when you have these chronic wounds, they're going to become colonized with bacteria. And there have been studies that show that the results of a superficial wound swab do not correlate with the pathogens that are causing the infection, either deeper down in the tissue or for example, in the bone if there's osteomyelitis. So, when you're doing these swabs, you may just be picking up colonizing organisms that are not involved in the infection.

Oftentimes, you may end up causing future you a problem because now they may be colonized with something like Pseudomonas or resistant Gram-negative or something else that throws a wrench in the antibiotic plan. So, it's really best to not swab these superficial ulcers. Now, ideally, if you're going to collect cultures, you want to get a tissue culture and usually that's done at the time of debridement. So, if someone's going to go in and clean out all the necrotic tissue, like remove all this gross colonizing dead stuff, get down to where the infection is actually happening in a sterile manner, they can then take a curettage off a piece of tissue or potentially bone depending on the type of procedure being done and the extent of infection and send that tissue for culture. That's going to correlate much better with what's actually causing the infection.

I think there may be someone who's saying, “Well, the only thing we have access to is swabs.” So, if that's really the only option, it really has to be done in one of those sterile procedures. But you can't just go around swabbing chronic wounds. You're going to find stuff that just confuses everything and it's not really relevant to the infection at hand.

Monee: So, I shall swat away.

Andrew: Yup, swat the swab, yeah.

[Laughter]

Monee: Love it. All right, so I think we hit that first half that we had in mind pretty well. RJ would you mind just doing a brief recap before we move on?

RJ: Yeah. So were talking about Mr. Footington, our patient that presents with the diabetic foot infection, and I think we had several great points from Andrew as went through the case. Specifically, I think in terms of thinking about advanced imaging like MRI, thinking about osteomyelitis, the probe-to-bone test being really important and sometimes obviously very beneficial in that situation, having somebody who's experienced with that though too. So, maybe operator dependence sometimes is a key there. I think another key point in my mind was thinking about that WIfI scoring system that Andrew mentioned and just using that as a framework to help predict the benefit of vascular intervention and possible ultimate amputation, things like that. Using that to maybe even help with some discussions with patients and your colleagues in general. Then finally, of course, as Monee would say, swat the swab, I think one of the most common questions I feel like I get here at Kashlak is about swabbing that wound because there's some purulence on the foot and just really hearing just emphasis about cultures, swabs like that best done from tissue in an OR debridement kind of sterile situation not the best idea at bedside.

Monee: Swat the swab. I hope it takes off. On that note, I will kind of move along with Mr. Footington. So, he's seen by podiatry, vascular and ortho whoever your particular satellite of Kashlak has at your hospital and they recommend debridement in the operating room. They defer antibiotics to me, which is always my favorite, isn't it yours Mereditth-

Meredith: Mm-hmm.

Monee: -always? So, clearly, we've established he's infected based on his exam and all the other stuff. So, he's not septic, Andrew but I'm pretty sure I need to start some stuff. Do I just do the whole kitchen sink? meropenem, vancomycin, micafungin, tell me what it is that I need to do and be a good doctor.

Andrew: Yeah. So, I think when you're looking at this particular case for Mr. Footington, so yes, he has a diabetic foot infection. We've established that. We think it's a moderate severity infection. He's been evaluated by our surgical colleagues who do think that he would benefit from a debridement in the operating room, which is great because we want to remove all the devitalized tissue. To your point, he's not septic. I mean, he has that borderline white count, but he's not febrile. His other vital signs aren't abnormal. We know for a fact that he's about to go to the operating room for this debridement. So, I actually think in this situation it's okay to hold on antibiotics until you get cultures in the operating room. Knowing what is causing the infection is so helpful for determining long-term treatment and minimizing toxicity of unnecessary antibiotics that trying to obtain that data whenever possible is really, really helpful.

So, I think most of us at Kashlak have probably heard it at one time or another, probably from an ID consultant that, “Hey, don't rush to the antibiotics, let’s wait and get cultures first.” That is appropriate in some cases. When that would not be appropriate, so if someone comes in and they do have evidence of a severe infection, so they have systemic signs of inflammation or infection, it would not be appropriate to withhold the antibiotics in that situation. So, you really have to look at the severity of the infection and the clinical extent of the infection. So, if this is also an infection which is starting at the wound but is clearly

involving soft tissues and has a concurrent soft tissue infection and cellulitis which is going up the leg, that's also not really a situation where I'd say, “Sure, let's sit on antibiotics.”

But if it's really a localized wound infection, especially when we know that there's an imminent plan for debridement and they're clinically stable, holding antibiotics for that 24 hours period so that you can get good culture data from tissue or bone cultures, depending on the extent of the infection will be really, really helpful in simplifying the antibiotic plan later. So, I think in Mr. Footington's case, it would be a very reasonable next step to say no great, you're taking him to the OR for debridement, antibiotics are on us. I'm going to hold them and then once he's out of the operating room, we have that culture data, then I'll go ahead and start him on therapy.

Monee: Okay.

Meredith: I have one. Is that your timeline threshold? Do you use about 24 hours to the operating room or is it more based on their clinical signs?

Andrew: Yeah, so it's more based on their clinical exam. There's not like a defined time. So, this is my expert opinion. Not really anything like guideline based, but to me it's more about the clinical status of the patient. Some of the patients who come into Kashlak may have had chronic open wounds that are going down probing to bone for two weeks and they finally just decided to get admitted to get all these different aspects of their care taken care of. They're really not having any signs of systemic inflammation or infection. They just have this necrotic bone that needs to be debrided.

If they're going to the OR in a few days and they're completely clinically stable. I'm fine waiting for a few days. If there're other signs of infection. Again, Mr. Footington's case, he's got that little bit of a white count. I'd prefer that they go sooner so we could get them started on something. But clinical stability is the end all be all. But if they're clinically unstable or have a significant clinical infection, then go ahead and start antibiotics. There's no guarantee that even a couple of days of antibiotics is going to sterilize these necrotic areas of tissue or bone. So, you can still get positive cultures in patients on antibiotics, particularly when there are these focuses of infection. So, if there's an abscess or these other things, you're likely still going to grow something.

Monee: I guess the natural question is so what if Mr. Footington was a little sicker, what if he did have some signs of sepsis, what would be a good first regimen to start him on to buy us some time?

Andrew: Yeah. So, empiric antibiotics for diabetic foot infection. So, this is, I think, one of the reasons why we talked about the classification system because the severity of the foot infection can often inform the empiric antimicrobials. So, to take it to the other extreme for a second, if this is someone who you're seeing in an outpatient clinic, who's coming in with what we would call a mild diabetic foot infection. So less than 2 cm around the wound, only superficial soft tissues involved, relatively acute in nature. Those are usually going to be just Gram-positive typical Staph/Strep. You can usually use things like Augmentin or cefadroxil. If they have a known history of MRSA, you might want to use something like Bactrim depending on your antibiogram, but you can just do an oral focused therapy for those mild infections and your hypothetical if Mr. Footington did come in with a severe infection.

So, that's a scenario where the risk of missing the pathogen in someone who's displaying signs of sepsis is very high. So, in that setting, the recommendation would be to go with broad therapy, which is going to include anti-MRSA and anti-pseudomonal coverage. So, if he was actively septic, he had fever, he had tachycardia, he had a white count of 20,000, he's trying to get to the OR then starting something like vancomycin and pip/tazo or

vancomycin and cefepime plus/minus Flagyl would be helpful. So, the trickiest part and I think a part where there's always a lot of back and forth, is what about those moderate infections? So, we know mild is relatively straightforward, just like a general soft tissue infection. We know that severe, you go all out because of the stakes.

So, for these moderate infections, which is kind of how Mr. Footington is presenting in the original then yet. There have been a lot of head-to-head trials for what antibiotics to use in diabetic foot infections and by and large they don't show any significant difference between the two compared antibiotics. So, they've looked at things like Unasyn versus pip/tazo, fluoroquinolones, just lots of different classes of antibiotics and there's not one clearly superior regimen. So, when I approach these infections, I try to think about their risk factors for certain types of pathogens and allow that to guide my therapy a little bit. So, for example, MRSA. So, who should have MRSA coverage for these moderate infections? Well, there are some described risk factors for Methicillin-resistant Staphylococcus aureus. You can look at prior colonization data if it's available, but if you look at Kashlak's antibiogram, which mirrors a lot of antibiograms around the country.

And you look at the proportion of Staph aureus which is methicillin resistant, it's somewhere between 30% and 50% most likely. So, that's probably high enough where you should just have everybody on empiric MRSA coverage until your cultures demonstrate MSSA, at which case you can deescalate. But the rates of methicillin resistance I think currently are adequately high where including that in your empiric regimen for moderate and severe infections is very reasonable. Gram-negative coverage is recommended for moderate infections. Pseudomonas is usually the big question that comes up and knowing when to cover Pseudomonas is a very difficult [chuckles] task and it's one that sometimes I even struggle with in terms of patients who maybe I don't think really have risk factors for Pseudomonas, but they already were started on it and they're better and so how strongly do I feel that I can narrow them off of it?

There have been a lot of studies that I have looked at the microbiology of Pseudomonas and diabetic foot infections. There seems to be some geographic distribution. So, areas with warmer climates, they'll say, like subtropics and tropics have higher rates of Pseudomonas. People who soak their feet have higher rates of Pseudomonas with that freshwater exposure. People who have a lot of healthcare exposure are immunocompromised. People who have been on recent antibiotics have risk factors for Pseudomonas. If you don't have risk factors, then there is a recommendation that you don't necessarily need empiric pseudomonal coverage. So, if I were admitting every single patient with a moderate diabetic foot infection, would everyone get pseudomonal coverage? No. But most people are going to have one of those risk factors and so it's often included. My general sense is that it's probably overused, but I get why. So, the last category that I like to think about is also anaerobic coverage.

So, I think anaerobic coverage is clearly indicated in some scenarios. So, in the more severe infections, like if there's a presence of gangrene or even in moderate infections, if there's an undrained abscess, if your x-ray that you get, which, as we talked about earlier, is a recommended evaluation for every diabetic foot infection, if your x- ray shows gas in the subcutaneous tissues, you should have anaerobic coverage. So, looking at all those features can kind of help you construct a regimen. For Mr. Footington, in this scenario, not knowing anything about history, if we assumed that he wasn't soaking his foot and that he's never had Pseudomonas in the past and he hasn't been in the hospital or taken antibiotics and Kashlak Hospital is somewhere cool right now, then you could do something like a vancomycin and Unasyn or a vancomycin and a ceftriaxone and then add Flagyl, for example, if you have any of those features of anaerobic infections.

Monee: No, that's all. I feel like we had all the microbes we worry about, there's a couple of things that I wanted to make sure we covered. So, in reading it seems like once the patients actually had a definitive, you always talk about source control and ID. So, they go to the OR and they have a really good debridement or they have all the necrotic tissue sort of given, say they came in sicker and then they had the surgical intervention. The timeline wise in terms of how long do they need to be on antibiotics after, I guess, is the next question. The two scenarios are they got the appropriate debridement or surgical intervention versus for whatever reason they weren't able to get everything. I imagine that dictates two different plans, correct?

Andrew: Yeah. So, again, it depends on the extent of the infection and the type of procedure done. So, let's say for example, you have a mild infection. They didn't need debridement because it was not too significant, generally two to three weeks. I like to err on the side of shorter because I think in general, we're learning that shorter durations can be used in a lot of these infections. So, for a mild diabetic foot infection, two weeks is probably appropriate. For moderate infections, it really depends on whether or not we're dealing with osteomyelitis and whether or not that osteomyelitis has been debrided. So, let's say for example, Mr. Footington had a good debridement. So, let's say he had a good debridement. They found out that it went down to the level of the bone, but they think that they removed all the necrotic tissue. In that situation, guidelines used to say anywhere from four to six weeks and my practice would be four weeks because he had good debridement, removed all the dead nonviable tissue.

So, at that point, a large burden of the infection has been removed. But since there's residual bone infection, you kind of do four weeks. There's some newer data suggesting that even maybe three weeks might be appropriate in the setting of well-debrided osteomyelitis. I think my comfort with that would probably depend in part on whether or not we had positive cultures and we knew exactly what we're treating. And that would probably play into that a little bit. If you had an infection that, let's say you don't have that debridement and you do have signs of osteomyelitis, that's a minimum of four. Typically, I'm going to go out towards six in those scenarios. So, without good debridement, I tend to treat towards a longer duration. So, if he had no debridement evidence of osteomyelitis, I'm going to treat that for six weeks.

Monee: Cool. And then one last question that's not very inpatient to you, but I just found it interesting in one of the newer articles that we read, actually, from earlier in June of 23, they mentioned one of the regiment, rifampin is being used-ish, did I read that correctly? Do you have thoughts on that. It's not like, obviously one thing. It's, like, added to other regimens. I was curious about that.

Andrew: Yeah. So, rifampin, I feel has been looked at. If you look at ID literature in addition of rifampin, it's been studied in so many different infections as an additive agent to see if it improves outcomes. I mean, there's definitely data for adjunctive use of rifampin in orthopedic infections. For example, we often will use it for prosthetic-related infections. For diabetic foot infections, it's not something that's routinely done. There are ongoing studies, and Kashlak has been part of that study. It's a very poorly tolerated antimicrobial. It has a lot of drug interactions. So, to me, the addition of rifampin, at least with the data that's available right now, I don't love and I'm not routinely doing that. I think the potential for drug interactions, the potential for side effects, are just a little bit too high to be routinely doing that right now based on the data we have.

Meredith: Going back to the timelines you were just giving before the rifampin question, are we presuming all of those are with IV antibiotics?

Andrew: Yeah. So, it's a good question, not necessarily and I think one other thing to focus on that we didn't touch on in terms of duration would be if Mr. Footington had got an amputation, for example. So, before we talk about the route of antibiotics, I think it'd be helpful to talk about post amputation. So, if people had an amputation and all of the infection was completely removed, then the duration of antibiotics really only needs to be about 48 hours. Now, I think the natural next question is, how do we know if all the infection was removed? And sometimes that's a relatively easier question to answer in terms of the level of amputation. So, if you have imaging that shows the extent of the osteomyelitis and you know where the surgeon went and you said they were far away from the site of infection and all the intraoperative bone looked really healthy.

We sent cultures and we sent margins and histologically and microbiologically, there's no evidence of infection. And the surgeon's confident they got everything, then you can only do a couple of days. If there's residual osteo in that setting, you treat it similar to a well-debrided one, and you would typically treat for an additional four weeks or so. Now as far as which antibiotics to give. So oral antibiotics are having a surge in the use of oral antibiotics for treatment of serious infections. We've seen this for a while for things like complicated urinary tract infections including those with bacteremia. It started moving towards what really, at the beginning of my fellowship, was the dogma of osteomyelitis get six weeks of IV antibiotics. And that really changed in just probably the last five or six years in terms of its widespread acceptance.

There have probably been infectious disease doctors advocating for this for a long time, but I think the bar was really moved, particularly with the OVIVA trial, which was when I was a fellow, so probably 2019 or so, which was primarily orthopedic infections, but including prosthetic infections. It was a noninferiority randomized trial which looked at oral antibiotics versus IV antibiotics, and they found that oral antibiotics were noninferior to IV antibiotics. So that really, I think, pushed the needle. In terms of most people's comfort with using oral antibiotics for serious infections, I think it's important to note that those, again, were mostly orthopedic infections. So, these weren't your diabetic foot infections, where there are other host factors and things to consider that are unique to the diabetic foot, which we discussed. So, it's probably not the best idea to just directly extract like that and say, it's going to be noninferior in every case.

But I am comfortable using oral antibiotics to treat diabetic foot infections including those with more serious infections like osteomyelitis. I think my comfort level with that really depends a little bit on whether or not we know exactly what we're treating. And again, this isn't strict guidance from guidelines. This is my personal opinion that I'm going to feel much more comfortable prescribing an oral regimen if I know what I'm treating. So, if I know that Mr. Footington had osteomyelitis at the base of this diabetic foot ulcer and we cultured it and we grew, let's say, an E. coli and it's susceptible to fluoroquinolones, and I know that fluoroquinolones are well absorbed and get good levels in bone. I know that his pathogen is susceptible, then I have no qualms about giving oral antibiotics for completion of his therapy to treat his osteomyelitis.

I do hesitate a little bit when we're giving empiric therapy, in part because if you look at Kashlak's antibiogram, you're going to find some common Gram-negative pathogens or other Gram-positive pathogens where it might be a little bit harder to find those drugs that are highly bioavailable, that get good levels in the bone, especially at doses that minimize side effects. So, it's not that I can't do empiric therapy, and it's not that I won't do empiric therapy, but I'm going to feel a lot more comfortable using orals when I have that extra data. But I think it's really important to also keep in mind that there are a lot of other factors outside in terms of the patient's socioeconomic background, their level of support, their comfort level with giving themselves infusions, housing situations, there are so many factors that come

into that I think it is important to note that you can successfully treat this with oral antibiotics. So, you have to look at the patient situation as a whole to make that determination.

Meredith: Yeah, I think that ends up being the most common way I've seen the orals get started is there is some other barrier to dispo. And patient's been in the hospital for a long time already and has already gotten at least maybe two to three weeks of the IV antibiotics. And that's when I think the question comes back to ID, can we switch them to orals to try to help expedite a dispo?

Andrew: Yeah, and some of the switch studies that have looked at transitioning people with diabetic foot infections to oral therapy have been done with very short courses of parenteral therapy. So, for patients who are getting their work up in the hospital and who have received a number of days and oftentimes, to your point, weeks of IV therapy, it's perfectly acceptable to transition into orals. But I would definitely involve your ID consultants just so they can make sure that they're picking the drugs that based on local micro data and all the other considerations are most likely going to be effective, make sure we're doing the right dosing and all those things.

Meredith: So, I know we could talk about antibiotics all night, but we won't. But I think the other important part to this patient's treatment plan is also the recommendations that our surgery colleagues are giving us for offloading. I think that we potentially overemphasize the antibiotics and what they can do. So, I was curious, especially for you, from an infectious disease standpoint, how do you counsel on the importance of offloading the wound as well?

Andrew: Yeah, so love the question and completely agree that I feel like we oftentimes give antibiotics too much credit for what they are actually able to do. So, it is so so important to look at all the other factors which go into successfully healing a diabetic foot infection. Remember when we talked about the definition at the beginning, these are infections that arise with wounds typically, usually diabetic foot ulcers. And again, the ulcer usually predates the infection. So, just because you have infected tissue and you give an antibiotic and you kill what's in the infected tissue, you will often still have this wound. Sometimes infection is part of the reason it's not healing, but there're often many other factors including biomechanical issues, the need for offloading, the need to correct other anatomic deformities that might be predisposing to the wound that really need to be addressed if you're going to successfully treat this and prevent recurrence of infection and other poor outcomes.

So, I always talk to my patients about four things that they really need to heal their wound. So, one is they need to have removal of dead tissue. If they have dead bone and they have a necrosum and this focus of infection, whether it be dead bone or abscess or something, antibiotics aren't going to get it and just magically clean up all this dead tissue. So, oftentimes debridement is needed. Not 100% of the time but ideally, debridement would occur in every case. Obviously, there are cases where it can't or it won't for a number of factors, but debridement ideally done. So, you remove the devitalized tissue that's necessary. Next, you need the right antibiotics. We've talked a lot about what those might antibiotics might look like. So, if you remove the devitalized tissue, you have the right antibiotics. You also need adequate blood flow.

So, that goes back to when we discussed the vascular supply issues and the need to really evaluate patients with diabetic foot infections for peripheral arterial disease so that we can make sure that we optimize their ability to heal their wound. So, you really need to look at having adequate blood flow not only to bring in oxygen and other things for the tissue, but that's how antibiotics ultimately get to the site of infection, whether or not they're given intravenously or orally, the blood is what's going to carry the antibiotics to the site of the infection. If you don't have blood flow, you're not getting any of the nutrients or the oxygen or antibiotics you need. So, you need removal of dead tissue, the right antibiotics, good blood

flow and then the fourth one, it's like a multilayered thing, but I just say you need like a good wound healing environment.

So, what I mean by that is you need to basically control all of the factors that are potentially contributing to that wound, of which there are many. So, offloading falls into that last one. And I always talk to my patients. One of the last things I say to almost all the patients at Kashlak when we're signing off or they're getting discharged is like, listen to your surgeon. Do what they tell you about this foot. One of the most common reasons that I see people do poorly postop is the inability to weight bear. So, they don't stay off their foot, the wound dehisces whether or not it's still infected or gets a secondary infection after it dehisces, those patients tend to not do well. So, it's really, really important to stress to them about wound offloading and listening to their surgeon about how they're going to do that.

I would take that opportunity to also talk to them about, do you understand your weightbearing restrictions? Do you understand how you're supposed to use this boot or this offloading device? Because it's not uncommon for patients to come in and be like, I didn't realize I couldn't do this. Make sure they know their limitations. Make sure they don't anticipate any problems with it. So, what do they do for work? Do they have stairs in their house? Are there situations where they can envision difficulty complying with these offloading instructions and to really just work with them to address those barriers? Some of the other things that fall into that grab bag category is like a wound healing environment as you know. Mr. Footington is a smoker, 30-pack-year smoker, you need to make sure that you tell him he's got to stop smoking. That's going to impair his wound healing. He's diabetic. You need to make sure he has good glycemic control which will impair neutrophil function for treating the infection and also impair wound healing. So, there're just so many factors that go into that. But that's how I lump in into those four broad categories.

Meredith: I guess we can actually just talk about this here because you just brought it up too is like the good glycemic control. This is probably a me problem, but I feel like I do not pay enough attention to their glycemic control until I'm getting ready for discharge. I'm like, “Ooh, that's the whole reason they were here for this infection and everything.” I was curious how aggressive, I guess, should we be in maybe getting endocrine involved or other consultants just because the glycemic control ends up being so important for the healing process.

Andrew: Yes, I think disclosure of being married to an endocrinologist, I probably have very biased view about the importance of diabetes control in general. But we do know that in terms of promoting healing and treating infection that it's really important. I think we probably oftentimes have data from their hospital stay in terms of like insulin requirements and other things that may allow us to adjust a regimen or improve their control. I think you can look at their A1c when they came in. Look historically at what their blood sugars have been and what historically their control has been and just really reiterate to the patient that whoever's managing their diabetes, because it's not always going to be an endocrinologist, it may be. Their primary care doctor but just to stress the importance that making sure their blood sugars are controlled is equally important part of this process.

Meredith: So, I think that's really helpful thinking about all these modalities that we have to think about for the whole patient treatment process for the diabetic foot infection. RJ why don't you tell us a little bit more about what happened to Mr. Footington.

RJ: Yeah, so Mr. Footington gets the debridement and the empiric antibiotic coverage. During this, he has noted marked improvement in his symptoms and is actually getting ready to go home. He has been seen by physical therapy and occupational therapy and it's recommended for home with additional therapy there. So, Andrew, what is your anticipatory guidance that you want to make sure he knows about?

Andrew: Yeah, so I think this discussion often will happen before discharge, but going over those same factors, we just discussed about making sure he understands how important all of those different components of his health are to healing. But then as an infectious disease doctor, my focus tends to be on giving him counseling on signs of infection. So, if you notice that your surgical wound is opening back up or you're starting to have fevers or drainage, giving some anticipatory guidance for signs that I would want to immediately know about, which might indicate that we don't have control of this infection we just spent all this effort treating.

I also like to be very intentional about giving anticipatory guidance for whatever antibiotics he's going home on. So, if he's going home on intravenous antibiotics, making sure he's comfortable with the infusion practice, making sure that he has the support to do those intravenous infusions, make sure he knows what that process looks like outside of the hospital in terms of delivery of the antibiotics, what his responsibilities will be so that we don't end up with someone in the emergency room saying, “I didn't realize what I was going to have to do.”

For oral antibiotics or really any antibiotics giving guidance on what the potential side effects would be, both what I expect and what I worry about. And so, for example, GI upset is common with a lot of antibiotics and so if someone's going home on Augmentin, for example, I might counsel them on diarrhea. And then I might also say what I worry about is a drug-induced liver injury as Augmentin is one of the more common causes, and so we're going to be monitoring lab work when you go home.

Anyone, who's going home on antibiotics. I always counsel on C. diff in part because antibiotic-associated diarrhea that's not C. diff related is so common, I feel like patients often may minimize it. So, I always like to give them some specific anticipatory guidance about C. diff. So, like, when would I be worried about C. diff. So, if you're having greater than three loose stools per day associated with fever or abdominal pain, that's something I'd like to know about. So, mostly I just want to make sure that transition to home covers all of those big talking points.

Meredith: I was hoping we could talk a little bit about follow-up care. I know I was reading a little bit about some multidisciplinary team approaches and things like that, and so what's the recommendation for who he should follow up with, and if you could talk a little bit about some of the multidisciplinary teams that exist.

Andrew: Yeah, so I think a multidisciplinary team is really the ideal way to handle this. I think, as we've discussed through Mr. Footington’s case, it's probably apparent why we may have a vascular surgeon who's doing an intervention for peripheral arterial disease. We may have a podiatrist who went in and did a resection or a debridement. We may have an endocrinologist who's helping him manage his diabetes. We have an infectious disease doctor who's helping to manage the antibiotics. So, there're so many facets to successfully treating this that you really have to have a multidisciplinary approach.

So, I think that when you're looking at who's going to follow up with a patient from an ID standpoint, we will see all these patients in our outpatient clinic, one to check on the safety of the antibiotics they're receiving, make sure there's no side effects, those concerns that we talked about before they were discharged, make sure that they're meeting the metrics that we're looking for that suggest successful treatment of the infection. But also depending on what type of procedure he had in the hospital, any debridement procedure needs to be followed ideally with the person who did the debridement at least once. They need to have longitudinal wound care, which is often going to be done by the surgeon in the setting of an operation. But let's say, he didn't get any surgical intervention, he still needs to be following with somebody for wound care whether or not that's establishing with the podiatrist or a

wound care clinic, someone needs to be monitoring the progress of the wound to make sure that there's not any delay in expected wound healing or any regression of the wound, which would suggest a problem with the treatment plan.

Then again, whether or not it's endocrinologist or primary care, following up with a specialist who are managing your relevant comorbidities. So, if it's managing the diabetes, managing the hypertension, he's a 30-pack-year smoker, really working with him to quit smoking, just touching base with all of those key players and what they bring to the table is going to be really important.

Meredith: Any take-home points you want for everyone.

Andrew: Yeah, so I think we referenced it already, but really go back and listen to Curbsiders. I think Monee said it was number 42, [Meredith laughs] which is really the prevention aspect because prevention is so important. I know we had a long in-depth discussion about treatment of the diabetic foot, but ideally, we prevent the patient from getting to this point to begin with. It was a really nice discussion that was done on that episode in terms of how to examine the diabetic foot, how to identify those who are at risk, what do you do about it? And prevention is just really, really, really key. The amputations that are associated with diabetic foot infections are just such morbid procedures understandably, patients are very fearful of them and unfortunately, they're all too common, even when diabetic foot infections are treated appropriately in a multidisciplinary way. So, really trying to prevent them from getting to the point where they develop a foot infection would be one main take-home point.

I think otherwise these are complicated infections. But I think you can use a stepwise approach to approaching these infections. So, if someone comes in, assess the severity of their infections because that's going to help determine the need for empiric antibiotics immediately and urgent surgical consultation. If they're presenting with an abscess or gangrene, you want to evaluate them all with a plain film, look for probe-to-bone, inflammatory markers, try to assess whether or not they have concurrent osteomyelitis. If those are not helpful, get that MRI that everyone's always bugging you about because it can be helpful. Be very deliberate about assessing for peripheral arterial disease and involve vascular surgery in those cases where there's any concerns. Just remember that your clinical exam may not be great for detecting that. So, really try to push for those noninvasive vascular tests and work with your team and your specialist to obtain appropriate cultures to get them on the right antibiotics and make sure that you're taking a whole health approach to the patient and not overlooking some of those other factors that we discussed.

Meredith: And lastly, anything you want to plug.

Andrew: Obviously, Curbsiders. This was a lot of fun. Thanks for having me.

[laughter]

Monee: We appreciate that.

Andrew: I think nothing personal, but I would plug infectious disease as a specialty. I really do. I love my job, I love my colleagues that I work with. I work with so many incredible people. It's such an exciting field. There's always something new going on. So, if you're a trainee or even if you're an established attending looking for a career change, definitely give ID a look. Talk with your local ID, friendly neighborhood ID doctors. I'm sure they'll be thrilled to talk to you about all the exciting things that we do in ID. We're a really fun and nerdy bunch, but definitely give ID a look.

[music]

Meredith: Awesome.

Monee: All right. Thanks Andrew.

RJ: Thank you, Andrew.

Meredith: This has been another episode of The Curbsiders, bringing you a little knowledge food for your brain hole.

RJ: Yummy.

Meredith: Oh, that was a good one. Still hungry for more?

Monee: Yep.

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RJ: And I have been Dr. RJ Blackburn.

Meredith: I am Dr. Meredith Trubitt. Thank you and good night.

[music]