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REVIEW

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VOLUME 2 – ISSUE 10: TRANSCRIPT

Featured Cases: Osteomyelitis/Diabetic Foot Infections

Our guest Author is Kristine E. Johnson, MD, Assistant Professor of Medicine, Division of Infectious Disease at the Johns Hopkins University School of Medicine.

After participating in this activity, the participant will demonstrate the ability to:

- Describe the risk factors for diabetic wounds and osteomyelitis
- Develop a strategic approach for the radiographic diagnosis of osteomyelitis
- Evaluate alternate approaches in refractory osteomyelitis

This discussion, offered as a downloadable audio file and companion transcript, covers the important issues related to managing patients with osteomyelitis in the format of case-study scenarios for the clinical practice. This program is a follow up to the Volume 2, Issue 9 eInfections Review newsletter—[Osteomyelitis/Diabetic Foot Infections](#).

MEET THE AUTHOR



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MR. BOB BUSKER: Welcome to this *eInfections Review*[™] podcast.

eInfections Review[™] is presented by The Johns Hopkins University School of Medicine. This program is supported by an educational grant from AstraZeneca, Cubist Pharmaceuticals, and ViroPharma, Inc.

Today's program follows-up on our July 2010 newsletter topic: Osteomyelitis and Diabetic Foot Infections.

Our guest is Dr. Kristine Johnson from Johns Hopkins University.

This activity has been developed for primary care physicians, internists, and infectious disease specialists caring for patients with infectious diseases. There are no fees or prerequisites for this activity.

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Learning objectives for this program are that after participating in this activity, the participant will demonstrate the ability to:

- Describe the risk factors for diabetic wounds and osteomyelitis,
- Develop a strategic approach for the radiographic diagnosis of osteomyelitis, and
- Evaluate alternate approaches in refractory osteomyelitis.

I'm **BOB BUSKER**, Managing Editor of *eInfections Review*. On the line we have with us Dr. Kristine Johnson, an Assistant Professor of Medicine in the Division of Infectious Disease at the Johns Hopkins University School of Medicine in Baltimore, Maryland.

Dr. Johnson has disclosed that she has no relevant financial relationships with commercial supporters.

Her presentation today will NOT include off-label discussions of drugs and/or products.

Dr. Johnson, welcome to this eInfections Review podcast.

DR. KRISTINE JOHNSON: Thank you, I'm glad to be here.

MR. BUSKER: To help increase our understanding of diabetic foot infections and how they may proceed to osteomyelitis, we've asked Dr. Johnson to discuss some typical case scenarios. But before we do that, Doctor, I'd like to make a comment on something you noted in the newsletter issue you wrote. Specifically, you state that as many as one in four diabetics will develop a foot ulcer, and up to 24 percent of those will require amputation. Those are some pretty extraordinary statistics.

DR. JOHNSON: Yes, indeed. These are data from the American Diabetes Association, and they give us an idea of how highly morbid diabetes can be, even for individuals who appear to have initially very small wounds, at least on external exam. It emphasizes the importance of having a good clinical perspective about how to address these wounds early in their presentation, as well as how to consider dealing with them when they become complicated.

MR. BUSKER: Dr. Johnson, overview for us, if you would, the risk factors among diabetics.

DR. JOHNSON: The risk factors for wounds include neuropathy and vascular disease, as well as poor foot care or no routine screening of the feet for evolving wounds. And really important, a lack of education among patients about the risk that neuropathy can develop from underlying wounds and to keep an eye on their feet. We encounter that commonly in the clinic, and this is a critical piece of continued patient care, even before they develop wounds.

MR. BUSKER: Again now, from an overview perspective — what do you see as the most common flaws in the diagnostic or treatment process? And by that I mean, what are clinicians doing or not doing that could help lower the amputation statistics?

DR. JOHNSON: That's a great question. Patient and family education at the time of diabetes diagnosis, as well as during their lifelong follow-up, is critical. I suggest a foot exam as part of every routine visit a diabetic patient has with the primary care provider, just to look for signs of callus formation over the metatarsals and the lateral foot; for Charcot deformity, a progressive degeneration of a weight-bearing joint that can lead to bone destruction; for reabsorption; and then ultimately for a deformity of the foot where there is a loss of the arch structure and evolution of a flat foot.

It's very important to pick up on that, as well as a neuropathy examination using a calibrated monofilament to screen for underlying but possibly clinically silent neuropathy.

Offloading shoes are important for protection when a patient has neuropathy or has early callus development. And finally, early surgical intervention for wound debridement can help prevent progression. There have been no large, randomized studies to demonstrate this, but rationally and intuitively it makes sense that if you have a wound with some necrosis and purulence, debridement may avert an evolving, more significant osteomyelitis that could be far more complicated down the road.

MR. BUSKER: I'd like us now to look at how some of these ideas can be applied to the bedside and the exam room. So if you would, Dr. Johnson, give us a case scenario.

DR. JOHNSON: The first case is a 59-year-old man who presented to the wound clinic with a plantar surface wound that was splitting the interdigital space between the second and third toes. He had a history of diabetes mellitus, peripheral neuropathy, and hyperlipidemia. Notably, his job in a publishing house required him to stand for about 8 hours a day wearing metal-toe boots. An x-ray revealed soft tissue swelling involving the second and third toes and widening of this interdigital space with a small number of air bubbles in the tissue between the second and third toes, suggesting an abscess.

His exam was notable for a wound depth of about 3-1/2 centimeters. There was seropurulent drainage and a positive probe-to-bone test. We empirically started him on ciprofloxacin and trimethoprim sulfa and brought him back for a follow-up visit 7 days

later. At that time he reported subjective fevers and chills at home, worsening pain in the left leg, and warmth and redness over the entire anterior foot.

He was admitted to the hospital for administration of intravenous antibiotics. At that time an MRI revealed osteomyelitis involving the third metatarsal and the proximal phalanx of the third digit. He ultimately required debridement of that foot with a partial third ray amputation, and at the time of his surgery there was frankly necrotic flexor tendon, and the metatarsal phalangeal joint was destroyed.

He was discharged to home with some oral antibiotics and achieved a full recovery.

MR. BUSKER: An interesting presentation, Doctor. Now, break it down for us, if you would: what are the most pertinent facts about this case?

DR. JOHNSON: This patient has a very clear risk for a foot wound. He has diabetic neuropathy and long duration of pressure on the foot, without appropriate offloading footwear. Those metal-toe boots are pretty scary for a diabetic to wear.

Additionally, his initial evaluation was highly suggestive of osteomyelitis, and he had a positive probe-to-bone test. He had gross purulence at the area, and antibiotic initiation at that time was appropriate. But notably at the time of his follow-up, he had developed signs of acute infection, including early toxicity. So he provided the history of fevers and chills and really wasn't feeling quite well.

Another point is, if an abscess is present, formal debridement, including early surgical intervention, may help avert progression to acute illness. If he had undergone debridement at his first visit, it is possible that subsequent acute surgical intervention might have been avoided, but the data pointing one way or the other on that are somewhat skimpy. Rationally, it could have been reasonable for him to have had debridement earlier.

MR. BUSKER: Let's talk about radiology — what role does that play in this case?

DR. JOHNSON: The initial x-rays suggested the presence of a soft tissue infection, and based upon this imaging alone, debridement was necessary. The presence of gas should raise concern for an anaerobic

infection, wet gangrene, and then less commonly, but also more urgently, necrotizing fasciitis.

MRI allowed assessment of the extent of bone involvement, which was not appreciated on the initial x-ray. So follow-up imaging in the form of MRI can be quite helpful in detecting osteomyelitis because the x-rays simply aren't terribly sensitive or specific in the early stages.

MR. BUSKER: And the role of postoperative antibiotics?

DR. JOHNSON: If the infected tissue and bone are debrided back to healthy margins, it's reasonable to treat with oral antibiotics for a brief course, such as a few days to two weeks, to resolve any residual infection that could be latently present. The goal with surgical intervention is that all infected tissue be removed; however, additional postoperative antibiotics give us some additional insurance that residual infection could be addressed, but it also just makes us feel good.

So depending on the surgeon's practice, some patients receive no antibiotics after debridement, and/or they get amputation to healthy tissue margins. But again, it's left up to the physician's discretion whether they use postoperative antibiotics. And often, depending on what they see in the OR and what they are able to achieve at the time of resection and debridement.

MR. BUSKER: Looking at this patient from a longer-term perspective, Dr. Johnson, what should the treating clinician be concerned with?

DR. JOHNSON: For this patient, the work requirement that he stand for nearly the entire work day is a big problem for him. And even with appropriate offloading diabetic shoes, the pressure on the foot can inhibit his healing. But it's most important in the broader sense to understand the challenges in caring for each patient who presents with diabetic wounds, to assess their home and their work environments as much as possible to determine any deterrents to the healing process.

A thorough social and medical history should be taken at the time of a patient's evaluation, and it's also critical in diabetes management. This patient has a considerable burden of disease and needs coordinated care through his primary care doctor to

address foot care, vascular screening, renal disease risk screening, and continued diabetic education to ensure that he can manage at home with keeping to a diabetic diet, monitoring his sugars, calling or coming in when he has questions or concerns, and certainly being aware if he develops any new foot or leg problems to come in when things are in the early stages.

So patient adherence to a care plan is quite important.

MR. BUSKER: Now you just mentioned adherence — so let me ask you, Dr. Johnson — from your experience, tell us what clinicians can do to help improve adherence to preventive care.

DR. JOHNSON: Spending the time with patients, even 2 to 5 minutes, explaining that staying with a care plan can improve their ability to not only maintain follow-up visits, but to help them understand how critical it is that they participate actively in their continued care and monitor themselves. They need to appreciate how dangerous the situation can become in terms of a limb-threatening process with these wounds.

Trying to guide them in that direction and taking the time to emphasize how important preventive care is for any areas that aren't affected by a wound, is critical. I think in the push for seeing patients quickly, sometimes it's easy for us as providers to potentially leave that out. It doesn't take a terribly long time and I think it can reap high reward in terms of patients' own commitment to their continued care.

When family members are present, include them in the conversation and try to address any of their concerns or the difficulties they've encountered at home trying to keep to a plan, can be helpful, as well. Using the hospital or clinic resources such as the nutritionist and the nursing team can be extremely helpful.

MR. BUSKER: And we'll be right back, with Dr. Kristine Johnson from Johns Hopkins.

DR. JOHN BARTLETT: Hello. I'm John Bartlett from the Division of Infectious Diseases at the Johns Hopkins University School of Medicine. I'm one of the Program Directors for eInfections review.

eInfections Review is a combination newsletter and podcast program delivered via email to subscribers. Newsletters are published every other month. Each issue reviews current literature in areas of importance to infectious disease specialists, primary care physicians, and other clinicians caring for patients with infectious diseases.

These podcasts, which are also available as downloadable transcripts, provide case-based scenarios to help bring new information into practice in both the exam room and at the bedside.

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MR. BUSKER: Welcome back to this eInfections Review podcast. I'm Bob Busker, managing editor of the program. Our topic is Osteomyelitis and Diabetic Foot Infections and our guest is Dr. Kristine Johnson, an Assistant Professor of Medicine in the Division of Infectious Disease at the Johns Hopkins University School of Medicine.

We've been discussing how the information presented in the newsletter issue can be translated into better patient care in the exam room and at the bedside. So if you would, Dr. Johnson — give us another case scenario.

DR. JOHNSON: A 67-year-old diabetic man hospitalized because of altered mental status was found to have had a cerebrovascular accident. As a result, he was left with left-sided hemiplegia. During his prolonged hospital stay, he developed a wound on the lateral aspect of his foot. This area persisted after several different local therapies. An MRI showed osteomyelitis on the fifth metatarsal.

A peripherally inserted central catheter, or PICC line, was placed and he began IV therapy with vancomycin, which was targeted for the methicillin-resistant *Staph. aureus* that was found in the wound, and oral ciprofloxacin, which was targeted for a fluoroquinolone-sensitive *Pseudomonas aeruginosa* in the wound. These were organisms from superficial cultures, so we had no deep cultures available at that time.

MR. BUSKER: And the most important facts about this case?

DR. JOHNSON: First I would say that foot wounds in diabetics can also be decubiti that are acquired during prolonged hospitalizations, with prolonged immobilization during these hospital stays. That's an important consideration in treatment because it tells us these patients need to be offloaded on their feet because they are bed-bound.

Additionally, patients with any kind of paralysis are obviously at risk for decubiti outside the hospital setting as well. We need to remember that patients who are status post CVAs or status post spinal cord injury are always at risk for decubiti, diabetic or not.

Finally, decubiti are a risk factor for osteomyelitis in diabetics, not just the evolution of foot wounds. You can have them in various locations on the body, and they're still going to be risk factors for osteomyelitis in diabetics.

When thinking about diabetic wounds, we often think about the feet, and in this case although he did develop it on the foot, the process was different from what we see in the ambulatory patient.

MR. BUSKER: Now you mentioned the feet, and we know that the heels in particular may be problematic. In these types of patients, what other areas might be at risk for osteomyelitis?

DR. JOHNSON: In this situation you would be thinking about the sacrum, the elbows, sometimes the upper back, depending on how the patient has been positioned, the lateral aspects of the knees if they have been lying in a dependent position on one side.

MR. BUSKER: Let's talk about wound healing. What factors can assist in that?

DR. JOHNSON: Optimizing nutrition, offloading the site of the pressure — in this case it would be offloading the lateral foot. Glucose control, local wound care, and when osteomyelitis is present, appropriate antibiotics for the underlying osteomyelitis are also important. Because wounds will not heal over infected bone, trying to direct the antibiotics for the organisms causing the infection is also important to achieve wound healing.

MR. BUSKER: In your presentation of this patient, you said that only superficial cultures were available, that no deep cultures were taken. Would you comment on that, please?

DR. JOHNSON: Because a deep culture — meaning a real bone biopsy — wasn't taken, whenever you see swab culture in a hospital report, generally speaking you have to assume that this was a swab taken from either the base or the surface of the wound. But we know that these don't correlate well with bone cultures in osteomyelitis. But I'll say this with a caveat that we do know *Staph. aureus* and *Pseudomonas aeruginosa* are pathogens that are seen frequently in diabetic wounds, so it is reasonable to cover these organisms when you are treating empirically and you don't have other data available. So in this setting, it's important to consider those organisms when you draw up what antibiotic regimen is going to be used.

MR. BUSKER: Let's talk about laboratory values. In osteomyelitis, which ones can provide the most useful information?

DR. JOHNSON: Inflammatory markers can be useful if they're followed during the course of therapy. We don't have anything specific for osteomyelitis to tell us, okay, there's bone infection present, here's a great blood test for it. But most commonly used are the C-reactive protein, or CRP, for sure, and the Westergren sedimentation rate, or ESR for short. Following these longitudinally can be helpful if you start from a point where they are significantly elevated. In patients being treated with vancomycin, it is important to follow the vancomycin trough levels at least weekly to ensure that these levels are sufficiently high to be therapeutic but not toxic, in which case they can induce renal dysfunction.

After that, it's important to be sure that the patient's kidney function and cell counts are being followed so that any systemic adverse events from administering the antibiotics are minimized. This is a patient safety issue.

Lastly, it's important to remember that some antibiotics will interfere with warfarin metabolism, and therefore, INR levels must be watched carefully with the initiation of certain antibiotics. Some common offenders that interfere with warfarin metabolism are trimethoprim sulfa methoxazole, rifampin, and the fluoroquinolones. So again, in this patient cohort, we're dealing with an older

population, some of whom are on anticoagulants because of either prior thrombotic events or prior CVAs, so it's critical to be sure we don't induce harm by adding an antibiotic without following up on the INR to ensure that they're not super-therapeutic or under-therapeutic on their anticoagulation.

MR. BUSKER: Now, I'd like to go back to this patient. We left him getting antibiotic therapy with a PICC line. Tell us what happened next.

DR. JOHNSON: The patient was discharged, and one week after his discharge he returned to clinic for follow-up and was reporting tactile fevers, chills, and nausea for about 24 hours. The visiting home nurse had drawn labs the day before, and we had those available. The lab results showed a total white blood cell count of 14,600 per cubic millimeter, so our standard measurements of 14.6 would be how we would talk about it.

The lab notified the care team of blood cultures, one set from the PICC line and another set drawn peripherally by the home nurse they noted that these were positive for gram positive cocci in clusters. The organism was identified as MRSA.

Since this patient's last clinic visit, the wound lengths and widths had decreased, but the depth of the wound was about the same. On physical exam there was no significant erythema, odor, or drainage.

MR. BUSKER: Let's start with the blood cultures. What do they suggest to you, and what would you recommend as the best course of action?

DR. JOHNSON: At this point they tell me this gentleman has developed a catheter-associated bloodstream infection, which is a well-known risk associated with PICC lines and other indwelling lines patients will use to administer IV antibiotics at home. The best course of action here is removal of the line. Because he had *Staph. aureus* bacteremia, we would want to make sure that he didn't seed a cardiac valve, so we would perform an echocardiogram. Additionally, repeating blood cultures to ensure that he has cleared the bacteremia is quite important and highly recommended.

MR. BUSKER: You described the physical characteristics of the wound. What do they suggest to you?

DR. JOHNSON: It's important to remember that the length and the width of the wound have diminished, which in most cases you would think wound is getting better because it's getting smaller. But in this case, the depth was unchanged, which suggests that there is unlikely to have been any significant intervening healing since the previous examination. In many wounds, tissue will grow around the opening of the wound, but it really needs to grow from the base upward and outward.

This leaves you with some concern when you detect it. The lack of drainage and the lack of odor are reassuring, but again, it doesn't ensure that healing is taking place. I mention that because in contrast, excessive drainage and foul odor would be worrisome for a continued or accelerated inspection that would have to be addressed again, either by hospital admission and debridement or further evaluation by additional imaging and so forth.

MR. BUSKER: And anything else to check on the physical exam at follow-up?

DR. JOHNSON: Because this gentleman has an indwelling IV line, it's important to at the line to make sure there is no evidence of erythema at the line insertion site, any purulent drainage underneath the dressing, erythema, or tenderness. Any of those things can suggest evolution of an early line site infection, or the patient is at risk. That should be part of the routine physical exam for any of these patients coming in with IV lines.

Sometimes it can be helpful just to remember to look at the line first, and then direct your attention to wherever the wound might be, and being sure to document that so you have it as a reference point later on.

Another key piece here is, some of the dressings that go on top of the IV lines can irritate the skin, and patients can develop hypersensitivity reactions, scratch the areas, which could put them at greater risk for introducing bacteria into the insertion site. So it's important to take a really good look at these as well. I think something that can be easily overlooked if they've got their clothes on, they've got their shirt on and you're looking down at the lower extremities and the feet. So again, that's an important piece to check when they come in.

MR. BUSKER: Now at this point, the patient is acutely ill, and we no longer have IV access. So what antibiotics should be administered now?

DR. JOHNSON: Once it has been demonstrated by negative repeat blood cultures times two days that a patient cleared the bacteremia, you can place a new PICC line; that's very reasonable. In the meantime, the patient will require administration of vancomycin through temporary peripheral IV, in which case he would have to be hospitalized.

At this point we're treating the MRSA that was in the wound, as well as MRSA that's in the blood.

You can continue to administer ciprofloxacin orally without interruption. You still have options. You can keep the patient as an outpatient if there appears to be no sign of acute illness from the wound, but the patient may have to be admitted, depending on how you are going to administer the drug for the MRSA bacteremia at this point.

MR. BUSKER: So with these treatments, how did this patient respond?

DR. JOHNSON: The patient received a new PICC line and was restarted on vancomycin therapy after his blood cultures cleared. In the interim he came into the hospital, had peripheral IV, demonstrated clear blood cultures, received vancomycin, and then went back out again.

We then completed eight weeks with vancomycin and ciprofloxacin for his osteomyelitis. The wound was then covered by a callus and the site was non-tender when he came back to clinic. At that point his ESR and CRP were within the normal range. Antibiotics were stopped and he was brought back to clinic a month later for follow-up.

At that time he was describing pain over that same toe, and following routine care, the callous was debrided away and this revealed a site of boggy tissue that was centrally tender.

That raised suspicion, what's happening here, do we have a continued problem, and a new MRI was performed. Unfortunately, the MRI showed osteomyelitis at the fifth metatarsal, in the same location where we had noted it before.

MR. BUSKER: Well now, let me ask you, Doctor, very directly, did this patient fail therapy?

DR. JOHNSON: The short answer is yes. Although his inflammatory markers reached normal levels, he still developed callus over the previous wound at the time his antibiotics were discontinued, or he had it at the time his antibiotics were discontinued. That suggests continued pressure at the wound site led to tissue damage.

This is something we've seen not uncommonly: you treat into the normal range and then a patient develops problems again in the same or a contiguous area. I suspect this was probably a partially treated infection and he responded to the earlier course of antibiotics. Then when that pressure was relieved and antibiotics were stopped, there was a resurgence of the bacteria in that same location, which we saw on both his physical exam and the MRI.

MR. BUSKER: With that being the case, what clinical approach should be tried with this patient now?

DR. JOHNSON: Now we have something that's not simple. It wasn't simple from the beginning, but now we have someone who had a wound, osteomyelitis, and bloodstream infection, who now has a wound again, and he has osteomyelitis in the same place again, unfortunately.

Looking at his environment for continued pressure at the wound will be an important component of modifying the clinical approach. Look at the patient's wheelchair to see whether the footrests create pressure against the lateral foot. Talk with the family about whether he's positioned at home with the foot leaning against anything that can induce pressure and callus formation.

You can also look at the arterial flow to that site by getting ankle brachial indices to determine whether he has any significant vascular compromise that could be intervened on to improve perfusion to that area. That may be worthwhile in this situation, if you can't determine that something is continuing to apply pressure to that area on the foot.

Further, you can obtain definitive cultures, because we only had surface cultures previously. It's possible that bone biopsy away from the site of the wound, but targeting the osteomyelitic bone, would be optimal.

Then you could target antibiotic therapy to whatever is in the bone, which hopefully would recover at this point. Since he's been off antibiotics for a while and now has infection in the bone, let's sample that bone and then depending on the culture results, target the therapy toward whatever is there.

This suggests the hypothesis that perhaps the previous antibiotics weren't getting at the organism that was causing the problem to begin with. That is one of the limitations of treating osteomyelitis based upon surface-wound cultures.

Finally, repeating imaging before discontinuing antibiotics can be helpful. It is possible he had some remnant of infected bone before antibiotics were discontinued the first time. So in the second go-round, take another look at what the bone appears to be doing before removing the line or stopping antibiotics, can also be helpful to the clinician in making a decision about whether or not to prolong or modify antibiotic therapy.

MR. BUSKER: Now I want to phrase this carefully, but let me ask you: In this patient, is it likely that an additional MRI might have avoided continuation of the disease?

DR. JOHNSON: In this setting, it's possible that if you had done the repeat MRI, you might have prolonged the use of the antibiotics. Perhaps to heal this patient's osteomyelitis, he simply was one of those people who require a longer duration of therapy, even though typically 6 to 8 weeks is what we say could be sufficient to treat osteomyelitis. Some people might require far longer than that, and I have certainly seen that clinically.

It would have been helpful to see that. My suspicion is that it probably was present at the time the antibiotics were discontinued, but it's also possible we could have had some settling of the infection, and then as I mentioned, the pressure is lifted, the antibiotics are stopped, and then he has continued pressure at that site, has continued nidus, and then blossoms into another infection.

So chicken versus egg is a bit difficult to know, but he had a continued risk, and unfortunately he didn't progress in the direction we would have hoped.

MR. BUSKER: Thank you, Doctor, for that very interesting case. Now I want to change the subject here, and I want to ask you: what would you like to see in the future, as far as potential advances in the diagnosis and treatment of osteomyelitis?

DR. JOHNSON: Great question. I think much-needed advances would be improved and economical screening modalities such as highly specific imaging that could be done quickly and is cost effective. We need serologic markers that are specific for bone infection. The CRP and the ESR are helpful, but it is still possible to have osteomyelitis with normal inflammatory markers. We need more advanced, less invasive technologies, including less invasive technologies for bone biopsy that wouldn't require a patient to go to the OR, but optimally could be performed in the office or the wound center. That would minimize the delay in identifying what organisms might be causing the infection and getting patients started on appropriate, targeted therapy.

It's critical to reduce the time and cost required to work up these patients and assess their conditions to target therapy and intervene as early as possible.

MR. BUSKER: I'd like you to wrap things up for us, Doctor, and review for us the key points clinicians need to be aware of when confronting osteomyelitis or potential osteomyelitis?

DR. JOHNSON: First, diabetic wounds are commonly polymicrobial, so always consider this if you are starting antibiotic therapy. Also keep in mind there is controversy as to whether addressing osteomyelitis with antibiotic therapy alone or whether early surgical plus antibiotic therapy is a superior approach.

Randomized controlled trials could provide some additional insight here, but could be pragmatically difficult. There is no clear standard of care in addressing this question, with the exception of when you have frankly necrotic tissue or bone that does call for resection in an acutely toxic patient.

Lastly, wounds beneath ulcers may be actually far more extensive than they appear, and that's why a good physical exam with probing of the wound is important, but imaging is an important consideration, particularly an MRI if osteo is suspected. But again, you have to consider that certain patients can't have MRIs, and in them alternative imaging therapies such

as bone scan or a tagged white blood cell scan with a sulfur colloid study, which is another type of nuclear medicine study, can provide the information you need. But ideally, an MRI is the best for going after what might be present.

Those, I think, would be the most important considerations.

MR. BUSKER: Dr. Kristine Johnson, from the Division of Infectious Diseases at the Johns Hopkins University School of Medicine — thank you for participating in this eInfections Review podcast.

DR. JOHNSON: Thank you so much. I enjoyed discussing this topic.

MR. BUSKER: This podcast is presented in conjunction with eInfections Review newsletter, a peer-reviewed CME accredited literature review emailed monthly to clinicians treating patients with infectious diseases.

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