

Editorial

"In My Experience...The Bugs Stop Here: My Journey Fighting Periprosthetic Joint Infection"

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The authors reviews his multiyear experience in treating periprosthetic infections.

I was fortunate enough, a long time ago, as a resident, to get a chance to work at the Kerlan-Jobe Clinic in Los Angeles. I had a chance to work with Larry Dorr and Kelly Vince. And if you think about it, those are landmark people, they're icons.

It's interesting. Even then, we were managing infections and it was so interesting because we were using Dakin's solution, which is a little scary. It hits everything—the good stuff and the bad stuff. I remember we would, even on the floor, if somebody had a "hole", we would just pour Dakin's in a little stainless steel pitcher and just siphon it out. I mean, it was amazing. I think we packed lap sponges as well. The thing is, back then, even as a resident, and I completed my residency in '92, the infections were present, but they weren't ever-present like they are now. Maybe it's my practice because I tend to have people send things like that to me, but it's just this exponential, algorithmic increase in the volume of infections that appear. And I think it's multifactorial. We're doing way more joint replacement by volume than we ever did back in the late '80s, early '90s, and certainly before that. We're operating on younger patients, we're operating on older patients, we're operating on sicker patients, and we're operating on patients that have had not just one surgery, but two, three, four, five, six, seven... I saw one patient who had 28 surgeries, and I was like, "Well, that's a lot of surgery, sir."

I've been a witness to all this over time because I've been in practice 31 years now. So, I went on from residency to do

a fellowship in Tampa. And our thoughts then were: Let's wash everything out (I think we were using Betadine), and then let's put some in-and-out drains, then let's irrigate with saline, and let's put a Gomco suction on another drain, and we're just going to run this through. And we're going to run this though until it quits bleeding and is clear. And then we're going to put everything on suction. We're just going to use antibiotics, and everything's going to be fine.

It was remarkable to see that actually, in spite of it all, even that stuff kind of worked. Beyond that, when I finally went into practice, as we saw more and more infections, the first time I saw a fungal infection was back in maybe '95. It was a rheumatoid patient, the dad of this guy I went to high school with and it was a Candida infection. I remember calling Ed McPherson out in Los Angeles. I said, "Ed, what do we do about this stuff?" He wouldn't remember that phone call because he had just finished working with Larry Dorr anyway and he stayed on there. Infection was just not so common, and that's all changed. Anyway, I get into practice, and I'm applying all these things I'd learned in the past. Honestly, it really wasn't working that well for me. We had a guy in our practice who was named George Cierny. Anybody that knows anything about the history of orthopedics and knows a little bit about infection knows the Cierny-Mader classification of osteomyelitis and their host classification, A, B, and C. It is one of the most simplistic but accurate representations of the type of patients that come through. So, for periprosthetic infections, we tend to

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see type 2 and type 4 osteomyelitis. Type 2 being superficial. Type 4 is the punched-out lesions, almost lytic areas around these joints. And if you see that, you know that these patients are in trouble. But George had this way of looking at things - and God bless his soul, he died in 2013 - he had this unique way of looking at infection. It was because of his tumor background. He did Ilizarov, he did tumors, and he did periprosthetic infection. A remarkable combination of skills and I had a chance to work with him, scrub with him. We were both in practice in the same group in Atlanta, but he was in a different hospital. I thought, "I have got to do it this way," because when I first got to town, everybody was talking about George Cierny and I was like, "Oh yeah, George Cierny, sure." I finally actually joined that group, and that's when I just hung out with him and his wife, Doreen DiPasquale—she's also passed. But just this body of knowledge, to just sit down with him, over dinner, or in the OR, and just absorb everything he had. I just sucked it right up.

One of the things that he convinced me was: the best way to manage patients if somebody's infected is to do all your debridement, and not just debridement, but really ridiculous, radical debridement - because that's what you do as a tumor doc as well - try to get clean margins. That was something, you thought you did a good debridement, but I learned that often it was inadequate. Anyway, I learned a lot from him on that.

Also, he did this thing called a "Double Setup". That's something I've adopted. I really preach on to a lot of other doctors that you have a dirty side and you have a clean side. On the dirty side, you go ahead and do all your debridement, clean everything out, remove everything, and then you close the patient up. I use antiseptic solution after I've irrigated and closed the patient up. And then you do a room turnaround. You get all that dirty stuff out of the room, and then you re-prep and drape. Originally, when you drape, you do a primary down-drape and you have the standard extremity drape placed on top of the down drape on the limb. You just take it off, down to your initial drape, and then you just, basically, re-prep and drape and start all over again.

If you used antiseptic soaked sponges, I use EXPERIENCE solution, and I use Bactisure, all those things are useful - anyways, you get those dirty things out, all the suture staples that you use to close up, all that stuff just goes off the field. Change your gloves. New sucker tips. Everything that you touch at that transitional stage, that's off the field. We have a little tray of instruments for that. And then, as we re-prep and drape, all of a sudden, we've got this new site to work on, a new limb that's ready to rock. So, you transition from the dirty to the clean. And we have the clean stuff in the room, but it's covered in a plastic drape. The scrub techs basically just grab either side and pull it away.

Magic. We've got everything, it's all new. Everybody changes their gowns, change light handle covers. We've got it down to where it's about 12 minutes, which is pretty amazing.

When you first do it, you go to a hospital, and they're like, "What the heck is even going on here?" But, I found

that the people that adopt it, all of a sudden, everybody wants to do it in that hospital, and they understand the reasons why. Because you don't want to close up anybody that's got a punched-out lesions after you've done all this debriding. You don't want to use the same instruments from the get-go, and that's part of this tumor background. You don't want to spread that tumor from the front end to the back end. This just dramatically changed my results, how I did things, and my outcomes. I explain this to the patients, what we're doing, and it makes sense to them. It makes sense to everybody intuitively. It's like, "Oh, yeah, I get that. That's the right thing to do." So, that's really been a boon for my patients. You sleep a little bit better at night knowing that you're doing everything you can.

Implant design has probably lagged a little bit in terms of what we can do to help patients, but I think we're starting to change that a lot. Having conferences that focus on that are, both useful and helpful. Back in the early teens, we started the "Disasterplasty" conference, and at first, it was every other year, and now it's going to be every year. Honestly, we did it a few years ago, and all of a sudden there was so much demand. Everybody was saying, "Hey, we've got to do this again." So, we responded, "Okay, well, we'll do it every year now." I think there's a unique niche for people who want to do that. They want to see more information, and they want to do whatever they can for their patients. It's a good environment for that.

I'm part of a fellowship training program in North Atlanta. It's through Total Joint Specialists, which is the parent group, and they're kind enough to allow me to tag-team with them. So, I do get a fellow that hangs out with me on occasion, but they see enough that I think they understand. Also, I've got the other staff Docs doing all my stuff (double set-up), so they get to see the process because it is a process to try to do this, you have to go through a sequence of steps. It's repetition, just like surgery, you get your staff to buy in and you're off to the races.

I may not look like it, but I'm actually 120 years old. I'll be 68 this summer. And honestly, there is that sort of physical burden of really throwing yourself into these cases. So, I have backed off a little bit. I'm actually doing more primaries than I've done in quite a long time. It used to be pretty much like 50:50, 60:40 revisions to primaries. But now, I've got people calling me saying, "Hey, I need you to help with this particular patient." And every once in a while, my staff will say, "We're up to here. We can't handle any more of this stuff. Why don't you turf that?" So, honestly, every once in a while, I'll call up one of the younger guys and I'll say, "Listen, I got..." and they'll say, "I'll take it." "You haven't even heard me, I got a..." "I'll take it." Because the young guys getting out, they want to get busy, and they want to do the work. But I've had them scrub with me, which is awesome. And they spend some time, so they get to see kind of how I do things.

There's one stage where you just go for broke. Clean everything out, put your final implants in, and just start praying. And then there's the two-stage, that I kind of reserve for patients with multi-organisms, a lot of bone loss. You just realize that you can't just hang your hat on one

stage. But what's going on right now, at least in my practice, I've gone to a 1.5, that's where I do culture negative debridement, put in implants that actually function well and can function for potentially years, it's worked out great. I've got patients that, for example, on the hip side, will get a PROSTALAC that have been in for a long time. I've tried to tell people, "Well, listen, you should maybe think about getting this out." They're like, "No, I'm good." Knees? Yeah. I've been using what they call a hinge in a box. Link has this product. Basically, it's almost like one, two, three sizes. It's a very simple rotating platform hinge. It's the original. What we do is we use that for negative debridements around the knee. Signature Orthopedics now has a 1.5 knee that they're going to be coming out with. And I've had an opportunity to help them with that process. It's a CCK-type knee. So, it's good for that tweener case. It's not a horrible disaster. But yes, you figure out you've got some bone to work with and it's stable from a ligament standpoint. So, there's that opportunity. Anyway, we're starting to see a little bit more of that.

Antiseptics are really key going forward. We've got to figure out a way to ditch all this idea that antibiotics or antibiotic coatings, antibiotics in beads, antibiotics in powder, all this stuff, that it's somehow going to change the dynamic. It's really not because you could sprinkle this stuff on biofilm and biofilm goes, "Yeah, bring it." So, I think that the key is developing antiseptics that disrupt biofilm and destroy it and can help with not only prevention but for these acute or chronic infections that you can irrigate and legitimately kill biofilm. So hopefully, we'll develop coatings that do that, that actually function, and well beyond just the time of implantation. That's a real key thing. If we can get that done, I think that'll be a great thing. And if we can get beads that actually contain antiseptic versus antibiotics, I think antibiotics have a very limited role. An IV as a supplement, or oral as a supplement, but it's not the end-all. And just sprinkling it into a joint that's infected is a waste of good antibiotics.

I do the same things that everybody else does, but what I do is I take it to maybe a little different level by using next-generation sequencing. Probably the best one out there is MicroGen DX, simply because they cover the most organisms. I think it's 50,000+ organisms now. And we've found some really obscure bugs. We had one that was a fungal infection of the knee, the lady had five, six surgeries already. She comes to me, and we do a NGS analysis on it. I don't even remember the name of the fungus now, but it was a fungus that's only found on the tips of pine needles. Get that! So, my infectious disease guy, who used to work up at NIH as a fellow, calls them up and says, "Do we have any record of this occurring in a human?" And they said, "Nah, never." Anyway, those are the kinds of things that you want to know because you want to know who your enemy is. Because so many of our prosthetic joint infections are just treated empirically because they never can get a diagnosis. "I'm sorry, nothing really grew out, so we're going to put you on X bug killers for 6, 8 weeks. We're just going to hope that it works." Well, that's a pretty bad way to man-

age things. And that's why I found that it's extremely rare, *ridiculously rare*, for me not to have a diagnosis.

For example, what I've done where my aspirate has maybe been inconclusive, or maybe my DNA analysis wasn't complete, is I take them in for an open biopsy. We do limited incisions around the hip and knee, and you go in there and take tissue specimens and swabs. It comes with a kit, you send it all off, and five to seven business days later, boom, you get the diagnosis. It's just critical to know what the heck you're fighting. And the thing is, sometimes these are multiple organisms. And they break it down into percentages. So, you want to hit the ones that have the high percentages, like if it's 50% Staph epidermidis, which is a common bug and should be picked up. Sometimes even stuff like that doesn't get picked up. You just want to be able to be accurate. The ones where you get multi-organisms and a fungus, you're sitting there going, "Holy crap, that's going to be tough." Usually, the patient's had multiple surgeries, had draining fistulas, it's just all this stuff. But then, get back to applying appropriate host classification.

A-host, that's your healthy patient, weekend warrior type, softball player, gets a joint replacement, let's say he gets infected. Well, there's nothing wrong with him other than the fact that he's got just this infection. They're easier to manage. You can get after those a lot of times. Maybe it's a DAIR procedure. Maybe they do need a spacer, whatever. Your outcome is going to be better because of that. But then you get into B-hosts where they have some complicating medical and, extremity issues. Then you get into the C-hosts, and this is the interesting thing. The C-host, George Cierny classified, is the one in which the curative treatment is worse than their pathology. I had a conversation a couple of weeks ago with somebody that had multiple surgeries, draining fistula, bone looked horrible, and he was on the youngish side maybe late 40s, early 50s, way too much surgery already. And he'd already had a flap, a gastrocnemius flap that had failed because now he's got this draining sinus. So, I just took him through the sequence of steps that it would take to do the curative treatment, and I said, *"If there's any misstep along the way, let's say there's a wound breakdown, let's say you have a recurrent infection, let's say the flap fails."* I said, *"And by the way, you've got to quit smoking,"* George always thought that it was a deal-killer for smokers, especially for osteomyelitis. Bad bone loves nicotine. I said, *"Listen, I think there's so many risks associated with trying to do a curative treatment for you that, by the time we're done and you lose your leg, rather than having a more distally based amputation, you're going to have a proximally based amputation."*

Those are really tough conversations, but they're super necessary. But the thing is, because I have that information in my hip pocket about A, B, and C, and just the experience I've had, those conversations they're in a sense, not hard because they're properly grounded and based properly. People don't want to hear it. The guy that had 28 surgeries, when I told him, "Brother, you need to have your leg off." He and his wife both just started crying because they thought I was going to say, "You need one more surgery."

They just started crying in the office. And they were so relieved that there was a solution that did not require more surgery.

It's the rare individual that actually has come in and said, "I want you to do an amputation." I've only had that a couple of times in 30 years where they're like, "I really want that to happen." And I say, "You really want that?" But the circumstances that they were under dictated that that was an okay solution for them. So, these cases take a long time. There's a lot of emotional upkeep associated with taking care of these people because you put it all on the line for them. It's different than a primary knee or joint. And there's a lot of guys I know out there that can do something and have a complication and treat it like they're playing golf. They just go to the next hole, and emotionally, it doesn't bother them. Well, for some of us, it actually bothers us. Of course, we're not Jesus, so we're not perfect. The patients expect the best out of us, so we've got to give them our best. But when it fails, it's misery. Whether it's the best guy on the planet that you're operating on or somebody that maybe lives under a bridge, you've got to give them the best you can. So that's the tough part of this type of practice. It's very easy for guys just to say, "Yeah, that's a pretty complex area. I don't really do that, I'm going to have you see this other guy." There's a lot of that out there.

Well, I think the next five years, we're probably going to see some improvement in some of our weapons. Again, I think the antiseptic solutions, some of the spacers, they're going to improve. But I think the problem is that we're going to be pushing a big rock uphill because bacteria outnumber us. There are more bacteria on our body than our own human cells. So, we're kind of surrounded, and that's how I see this. I see an encroachment of periprosthetic infections. They're going to encroach, and they're going to get closer and closer to us. So, routine primaries may not be so routine because of the threat of infection. Unless we can turn that around because it's not like we come out with new antibiotics every day that kills stuff. And also, I think it's expensive to develop these things. And then, if you just don't get enough proper kill, **there's** phage therapy, which I don't know enough to really talk from an educated standpoint about, but that's conceptually something that could help. If we have a way to infect a bacteria with a specific protein, viral protein, I think we're going to see some more of that in the future.

I think that there is a special realm for this work. Unfortunately, nobody's paying us more for it. I've got a friend in Italy, Pietro Randelli, he tells me that they get paid more for doing infection. I don't know what it is or how much it is. It may not be as much as we would all like to imagine. Nevertheless, there needs to be some reflection of difficulty in the type of work that we do. The type of debridements we do, the work that's involved, the hours to get stuff done, it's like, "Oh my gosh." And those guys doing the primaries are home at one o'clock. So, special training would be useful, it needs to be in centers that really have an understanding of the management principles and do it, but those guys are already overburdened. The guys that do it, that embrace it, we're all kind of overburdened with it.

Right now, job satisfaction, it's ebbing somewhat. Orthopedic surgeons have the highest rate of suicide of any surgical specialty, higher than neurosurgeons, ENT, oral. We're number one in a terrible category. So, something has to give, and I don't know where. Maybe it's just on a personal level, people just need to give themselves some grace and seek help when they need to, but I think that's important. In 2017, I was kind of struggling with a lot of whys and whats, and, man, this is such hard work and has emotional challenges. I'm a veteran, and I was coming back from the West Coast, from Los Angeles. I was doing a meeting out there and I was watching a documentary, and it was called 'Thank You For Your Service'. Now, there's a movie also called 'Thank You For Your Service'. That's Hollywood but there's this 90-minute documentary called the same thing. It's basically about the suicide crisis in the military, and being a veteran, I was like, "This is very compelling," so I watched it. Of course, by the end of it, I'm basically crying because it's so real. They highlighted this program called Save a Warrior, which is actually a program for suicidal veterans, guys in complex PTSD. So, I reached out to them and said, "Hey, I'm an orthopedic surgeon. I'm a veteran. I see you guys do some physical tasks, they had a ropes course and things like that. 'I'd be happy to help,'" and they said, "Well, we don't really need an on-site medical person but if you want to just attend and come out, you can." Anyway, you have to fill out a form, fill it and then you press submit. That's an important word, submit. That means you're submitting to their process rather than accept or whatever.

Anyway, I filled it out and pressed submit, and they got back to me saying, "You know, you may want to attend as an attendee, there are some things you wrote down about what things are happening in your life right now that I think maybe you should just be a full participant." I said, "Alright, I'm all in." So, I went out there. It was a five-day program; now it's 72 hours. It's like a diamond now. Back then, it was a little broader. And man, it really changed my whole perspective and changed my life to a high degree. It took me out of a dark place.

Anyway, I still go back now. We've run 2,600 men and women through—it's phenomenal. Disabled American Veterans, which is a huge organization, is now a principal sponsor for us and funded a center. We have this center of excellence, essentially, for that. I just got back a couple of weeks ago; it's so wonderful to help people in that respect. And the thing is, I would never begrudge anybody for going to South America and operating on people that need surgery. But man, if you can save somebody from killing themselves, then what you've done is transgenerational assistance and help to an entire family line. We know that there's a lot of suicide in the subsequent family members, the next generations. Anyway, that's just been a wonderful thing to witness because what it does is, you achieve a form of catharsis. I tell you what, I know a few hundred surgeons that would probably benefit from something like this, but I worry that their egos are so big, they could never admit to some of the things that you have to admit to in this program. Because you really got to come face to face with things that you've shielded, hid, that you're going to take to

your grave, stuff like that. So, what I found is, it's given me a wonderful perspective, and it's been good for me and my family to have gone through it.

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