

Periprosthetic Joint Infections

New Generation of Treatment Strategies, Antibiotics, and Outcomes



Part 1: Problems with PJIs

1:14

Dr. Jane Caldwell

Hi, I'm your host Jane Caldwell. It's estimated that over 65% of all human infections are biofilm related. Commonly used biomaterials for orthopedic surgeries are highly susceptible to colonization of biofilm-forming bacteria.

Periprosthetic joint infection, or PJI, is a devastating and costly complication following total joint arthroplasty. Prevention and treatment are therefore a top priority for orthopedic surgeons and infectious disease specialists. This CME accredited series will be aired in four parts.

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Part one will discuss patient and economic cost to PJI. Part two, new strategies for dealing with PJI, including choice of materials and antibiotics.

Clinic of Hope in Durham, North Carolina will be highlighted in part three. Our guests will discuss the establishment of the multidisciplinary practice at the Clinic of Hope and how it improves outcomes. Finally, part four will present information on PJI prevention for the high-risk patient.

2:37

Dr. Jane Caldwell

Our guests for this accredited podcast series are Dr. Jessica Seidelman and Dr. William Jiranek. Both work at Duke University School of Medicine in Durham, North Carolina. Dr. Seidelman is an associate professor of medicine specializing in infectious diseases with a clinical interest in musculoskeletal infections. She has a particular interest in surgical site infection prevention. Dr. Seidelman is co-director for the Duke University musculoskeletal infection program and the Duke Infection Control Outbreak Network, which serves many hospitals across the Southeast United States. She is also content creator and co-host of the podcast, Joint Approach, which is the official podcast of the Musculoskeletal Infection Society.

Our second guest, Dr. William Jiranek, is a professor of orthopedic surgery at Duke. He works in adult reconstructive orthopedics, predominantly with hip and knee replacement surgeries. He also manages revision surgeries and takes care of people with infections or fractures around their implants. Dr. Jiranek's research focuses on tissue-guided restoration of the articular cartilage of the knee, joint infections, and the immune response to biomaterials.

04:18

Dr. Jane Caldwell

Dr. Seidelman and Dr. Jiranek, welcome.

Dr. William Jiranek

Pleased to be with you.

Dr. Jessica Seidelman

Thanks so much for having us. Excited to be here.

04:31

Dr. Jane Caldwell

Today we're going to lay the groundwork for our discussion of PJIs by reviewing the prevalence and economic cost of these nosocomial infections. First of all, let's define PJIs, biofilms, and how biofilms are formed. Dr. Seidelman?

Dr. Jessica Seidelman

Sure, so PJI or a prosthetic or periprosthetic joint infection is really a serious complication that can occur after joint replacement surgery. It happens when bacteria or other microorganisms infect the area around the artificial joint, most commonly in the knee or hip.

Even though these surgeries are generally safe and really highly successful, there are a small percentage of patients, 1 to 2% in general, that develop PJIs. Now where this gets a little interesting and tricky, when we start talking about biofilm. So, biofilm is kind of like, a shiny, I'm sorry, a shiny but also a slimy shield that's made by bacteria. And once bacteria attach to the surface of a prosthetic joint, they begin to produce this really protective layer made of proteins, sugars, other kinds of organic matter. And it's really like the bacteria building a fortress. It's actually incredibly beautiful from an evolutionary standpoint how robust this is and how protective it is for these bacteria. And they basically hide inside it and become incredibly hard to detect or destroy by our immune systems or by systemic antibiotics for that matter.

And inside these biofilms, the bacteria actually go dormant or hibernate is kind of how I like to describe it to patients, which makes them again, less sensitive to antibiotics and almost invisible to the immune system. And this is really why PJIs are so persistent and hard to treat. And they differ a lot from your standard infections when people typically think about things like blood infections or urinary tract infections.

06:43

Dr. Jane Caldwell

Thank you, thank you. The increasing frequency of total hip arthroplasties and total knee arthroplasties has been accompanied by a rise in PJIs and surgical site infections. As of 2020, PJIs cost over \$1.62 billion annually with individual case expenditures averaging \$90,000 per patient occurrence. Dr. Jiranek, why do you think we're seeing an increase in these surgeries?

Dr. William Jiranek

So, I think I want to clarify, I'm not sure that the incidence, which as Dr. Seidelman's already said, is somewhere between 1-2%. I'm not sure that's increasing, but the number of joint replacements we're performing in this country and also across the world has increased dramatically. So, the prevalence is certainly increasing, and people look around and they say, wow, we see more infections than we used to. I think it's probably a factor more of how many of these joint replacement surgeries are being done.

08:01

Dr. Jane Caldwell

Is age a factor or are there other comorbidities?

Dr. William Jiranek

There are plenty of comorbidities that affect your risk of infection. And the 1-2% is taking all comers, the very healthy people combined with the sick people. The people that are really debilitated, I think, have a much higher risk of PJI. And this has to be discussed with the patient. And I think in some cases it may make it difficult to actually do the joint replacement; should make us checkup before we do that. And I think there's a big push that's happened in the last 15 years in joint replacement to optimize the patient before surgery. So, if they have something that threatens their immune system, threatens their ability to have a good result, we want to try and fix it before we operate, not afterwards.

09:08

Dr. Jane Caldwell

Dr. Seidelman, could you address the increase in PJIs associated with these surgeries and the frequent need for revisions?

Dr. Jessica Seidelman

Sure, so I think kind of like Bill alluded to, right? We're in general are just doing more joint replacement surgery. So, if you take 1 to 2% of say a hundred thousand versus 1 to 2% of 1 million, the end is going to be bigger, right? So, in general, we're just doing so many more. You know, I think that there's like you were alluding to, there's some risk factors that we're now putting into that. So, we're not just doing more patients, we're actually doing more high-risk patients. So that may be older patients, but not just age. Like these implants have a little bit of a shelf life. So, it's not uncommon for us to see patients say, I had a knee replacement done in 2000 and now it's worn out, right? I need another one. And just the fact that this is a revision versus a primary, increases your risk of prosthetic joint infection. There's also a lot more people, I'll say particularly in the United States, that have more risk factors such as obesity, uncontrolled diabetes. We see a lot of patients that are on these new biologic agents, or new chemotherapy agents, which put patients at an increased risk.

And then, now, even at Duke, I see a lot of, I shouldn't say a lot, but we have a fair number of transplant patients, which again is significant in terms of the risk of PJI. The other thing I'll say, and I think that a lot of folks probably listening to this are aware, is that we're seeing more antibiotic resistance. So, people are being treated a lot in the community for pneumonia, for urinary tract infection. And while that may be helpful in the moment for that, it actually contributes to the issue of more resistant bacteria, which makes it harder to treat some of these prosthetic infections or makes folks have different microbiome on their skin, which is how we think that surgical site infections or prosthetic joint infections primarily occur.

And I think the last bit is that we are actually getting better at diagnosing prosthetic joint infections. So, I think that there was a time where we might have said, this joint is just a little loose. We're just going to exchange it. And I think there's now a big push, particularly for revision surgeries and even in the diagnosis of a painful prosthetic joint to culture those, get pathology, to do things like next generation sequencing to actually find these bacteria more effectively.

12:10

Dr. Jane Caldwell

Thank you for that explanation. Let's talk about some other financial burdens associated with PJIs. The Centers for Medicare and Medicaid Services imposes penalties on healthcare providers, particularly

hospitals and skilled nursing facilities for infection control failures. The Hospital Acquired Condition Reduction Program can determine penalties, including a 1% reduction in CMS payments for hospitals that rank in the lowest quartile for hospital-acquired infections. And in addition to HACRP penalties starting in 2020, hospitals with high readmission rates also face penalties under that program. This can potentially reduce reimbursements by up to 3% of the total Medicaid revenue. And I'm going to ask you both, are these penalties reasonable and do you intend to push back?

Dr. William Jiranek

I think that there's a lot of slip between the cup and the lip in these kinds of situations. Comorbidities that we just talked about that contribute to whether somebody, their risk of infection, differs between lots of hospitals. And so there has to be a system to risk adjust that, and while CMS has been working on this for at least 20 years, it's not completely robust yet. So, there's an opportunity for inequity. The second thing that they have to tease out is where the patient comes from. A lot of the patients were actually referred to a hospital, particularly a tertiary hospital that the original surgery was not done at that hospital and they're being asked to care for the infection. So, defining what truly was a post-op infection is you would think it would be fairly simple, but it's not with our current coding systems. So, I think it puts hospitals that take care of a lot of prosthetic joint infection and want to become centers for that, it puts them in a difficult spot. And I think that I'm not sure your conclusion that the incidence of infection is increasing. I think we need to be careful about that. The prevalence, the number of infected joints is certainly increasing because we're doing, you know, double, triple, quadruple the amount of joint replacements we did five years ago. So, I think that it's still a problem. It's a problem that could cause, that could ultimately hamper joint replacement. And so that's why Dr. Seidelman and I are working so hard to figure out good treatments for it.

15:49

Dr. Jane Caldwell

Understood. Dr. Seidelman, do you have anything to add?

Dr. Jessica Seidelman

Yeah, I think as someone who does a lot of surgical site infection research, you know, there are limitations to this system. So, for example, like Bill was saying, if a patient happens to have surgery elsewhere, they get an infection and that center may not feel like they can reasonably take care of that patient. They may come to a tertiary center like ours. So that patient, if they may not actually be counted as a PJI or an SSI because they're not getting readmitted to that same facility for surgery. The other thing that limits the current system in terms of the CMS reimbursement is, you know, they limit the window to 90 days in terms of if a patient is going to return with signs and symptoms of infection. In a world like ours with PJI, it is not uncommon if we have some less virulent organisms, like say, cutibacterium or coagulase negative staph, those infections may not show up within 90 days. So, I just think that, you know, to kind of go along with what Bill is saying, there has to be a little bit of caution. And I fully appreciate that there has to be a robust model that can be applied. There's not a full catch-all, but these infections, I think, are difficult to put in with everything else because of the implant material. And I also do think that what we are seeing in particular is that there are fewer centers that are able and willing to effectively care for these patients because of the significant complications that come with it, which I assume we'll talk more about in just a minute.

17:50

Dr. Jane Caldwell

Yes, can you give us some specific PJI symptoms and surgery complications that you've treated?
Dr. Seidelman?

Dr. Jessica Seidelman

Sure. so, you know, when it comes to symptoms of a PJI, again, I think a lot of this really depends on the organism. It really depends on the actual patient. It'll depend on how far they are out from surgery. Right. But I think in general, when we think about symptoms of a PJI, we think about persistent pain around that joint. I'm not talking about like, I was working out with PT, and I really pushed myself today and now my knee is sore. I'm talking about that like, dull ache, you know, that you just can't get away from. Obviously swelling, redness, warm.

There are patients that will present with fevers or chills. And typically, that means that the infection is not contained to just the implant and the bone interface, but it's actually gotten to the soft tissues and seeding the bloodstream in those cases. The other thing that we see a lot of is drainage. I think persistent post-operative drainage is something that people cannot, you know, ignore. It's not something like, well, maybe it'll get better if someone is having persistent post-operative drainage. That is something that absolutely has to be paid attention to. And then loosening or instability of the joint. And again, this may be more of a sign of some of those less virulent organisms like I was talking about that kind of slowly over time, just loosen that cement interface with the bone and the prosthetic joint itself.

Again, sometimes these are really subtle, especially in chronic infections that can be smoldering for months. But I think in general, those are probably some of the big ones that Bill and I see and ask about in clinic.

19:47

Dr. Jane Caldwell

Dr. Jiranek, would you like to add to this, please?

Dr. William Jiranek

I think that as a clinician, seeing a patient who's had a joint replacement, by far the most common situation is continued pain. And it's not just pain with activities, it's pain all the time, as Dr. Seidelman just said. It can bother them more at night than during the day.

But the loosening of the implant, associated fractures, et cetera, tends to happen late in the infection course. So, I think what we're trying to get across is a high index of suspicion. If you do a joint replacement and somebody continues to complain of pain, you absolutely have to rule out infection.

20:45

Dr. Jane Caldwell

Thank you so much for your insights. We'll talk again in part two where we'll discuss in greater detail new strategies for PJI prevention and treatment.