Necrotizing Fasciitis

Maggy: My name is Maggy, and my story begins nearly two years ago on New Year's Eve. My family went for a short hike in the woods that morning and then met some friends to go bowling. That evening, I thought, *maybe bowling had given me bursitis,* as my elbow felt unusually painful. We went to bed long before ringing in the new year, but the pain kept growing. I really wanted to sleep, so I made an ice sleeve out of a sock, but that pressure was too much, so I resorted to an old prescription pain med and waited impatiently for that to kick in before adding ibuprofen to the mix. Soon after, my husband found me lying on our bedroom floor, as I felt like I might pass out. He thought this was just my normal response to pain because I have passed out in the past, but later I began vomiting. Which I then attributed to taking meds on an empty stomach. By morning, I could not get out of bed I was so sick. My husband kept trying to get me to stand so we could go to urgent care, but I couldn't. I finally felt a short window, and we made it downstairs to the car and headed straight to the ER instead. My husband wheeled me in with my bucket and they found my blood pressure was considerably low. My normal resting heart rate of around 60 was elevated to 94 beats per minute. I also coincidentally tested positive for COVID, so the ER gave me my own room with full COVID precautions in place. On the second day, after multiple bags of IV fluids that failed to bring up my blood pressure, they transferred me to the intensive care unit to treat me for septic shock. It's worth noting that three to four days prior to all this, I had visited my general practitioner for a lingering cold or sinus infection. And I was about three days into a prednisone prescription to calm down my inflammation. I was feeling good, but my immune system had clearly seen better days.

Maggy: This whole time, my arm had a noticeable redness that radiated from my elbow, and it was growing by the hour. Doctors were tracking the spread with sharpies, and there was a lot of discussion about whether to operate. My amazing infectious disease doctor was pushing for this to happen. I could hear my own voice telling my students how this can happen to anyone, but I could not believe that I was now that person. I remember trying to mentally prepare myself to give permission to amputate my arm should it become necessary to save my life. As the pain and redness approached my armpit and shoulder, they found a surgeon that agreed to perform a debridement of my arm. They opened me up with four long incisions that averaged three to four inches apiece, and after surgery they were wide open with all my deep tissues on full display.

Maggy: My dad was sent a picture, and he passed out behind the wheel just thinking about it. He survived and his car did not, and it's pretty clear where I get my vasovagal response. My left arm had undergone so many blood draws

and IVs that I developed a painful clot, forcing doctors to put in a central line to continue my meds. I was on at least three different antibiotics, and now I had to worry about the risk of a new infection going straight to my heart, as any catheter comes with the risk of infection. My most unpleasant memories, though, were the nights. I insisted my family go home to sleep at night to stay strong and healthy. But many nights I cried myself to sleep, terrified. I could not turn in my bed, and the morphine drip gave me startling dreams that would waken me. It was one of those nights I sent an email to the Erins, asking them to save me a spot for when I beat this infection. I had made the mistake of reading the dire statistics for my condition online, and I was not about to leave my 6-year-old son or my husband behind.

Maggy: In the end, I had three surgeries, including another where they placed a wound vac on my elbow and another to insert a wound drain and staple my arm closed. I was in the hospital for nearly nine days. I went in with suspected bursitis, but the list of "itises" kept growing. I had cellulitis, toxic shock, sepsis, septic shock, and necrotizing fasciitis. The culture confirmed the infection was caused by Group A Strep. I was sent home with IV penicillin through a PICC line in my left arm while the wound drain hung from my right arm. I felt a bit like Pinocchio with so many strings, but I was grateful to be home. I was very fortunate throughout all of this to have such great support and grateful to my husband and my sisters, my care team, and all the friends and family who supported us through this scary time. We felt so loved and we hope to never have to experience love in this way again.

EW: Oh my gosh. That is, I, I mean, it's so, it's terrifying.

EAU: Yeah, it is. Oof.

EW: Ugh. We're really glad that you're okay and we appreciate you so much for being willing to share your story. That scary, scary story. Yeah.

EAU: Yeah. Thank you. Thank you so much.

EW: Yeah.

EW: Hi, I'm Erin Welsh

EAU: And I'm Erin Allmann Updyke.

EW: This is, This Podcast Will Kill You.

EAU: And today we're talking tissue death 'cause we're covering necrotizing fasciitis.

EW: We've covered, as I was doing the history, much of this in other capacities. I mean, this is a strange beast of thing, right? Like NF said. Okay.

EAU: Enough said. I agree.

EW: Yeah. Because we're talking like multiple bacterial species or groups, but it, there are so many questions that I have and so I really just wanna like, go straight to things. So let's just get through the rest of this business quickly. Yeah.

EAU: Sounds good. First, it's quarantini time.

EW: It is, it is. What are we drinking this week?

EAU: We're drinking, hit the gas.

EW: Erin? What does gas mean?

EAU: It's like, it's one of those where you have to explain it, but it works on so many levels. Once you do, gas means group A strep, but it also means gas as in air bubbles, which you might see on imaging if you have an necrotizing soft tissue infection.

EW: And in keeping in line with the gas air bubbles, of course our drink is a, well, our placebo this week is a, um, club soda plus blackberry syrup, plus lemon juice.

EAU: there you go. We did it, guys.

EW: We did it. Um, we'll post it on our website. We're going to try to, plus definitely social media, we will be posting it there, so make sure you're following us. We're also on YouTube, so make sure you're subscribed and all of that to the exactly right. Media YouTube channel. We have a website where you can find all sorts of things like transcripts, like our Submit your firsthand account form a Goodreads list, bookshop.org affiliate page sources for each and every one of our episodes. Uh, music by Blood Mobile, and some more goodies. So check it out.

EAU: This podcast will kill you.com. Great. Shall we

EW: We shall

EAU: Okay. Right after this break

EAU: In some ways, Erin, I think of necrotizing fasciitis as like an old friend of the pod.

EW: Yeah. I think that's fair to say. I.

EAU: Thank you. I'm glad you, I'm glad you agree because we have covered so many of the major causes of necrotizing fasciitis. Classically, the primary agent that we think of with a necrotizing fasciitis infection is a beta hemolytic streptococci called strep pyogenes, AKA group A strep, AKA, the cause of scarlet fever among many other things.

EW: we have done.

EAU: Exactly. We've done that. We've also done,

EW: Yeah.

EAU: we've also done toxic shock, uh, very recently, which necrotizing fasciitis often leads to a toxic shock syndrome.

EW: Mm-hmm.

EAU: Necrotizing fasciitis also can often lead to sepsis, which we've also covered,

EW: I mean, I think this just goes to show, if I, if I may be a little, not like philosophical, but I guess like historical, you know, back when germ theory was the newest thing of the day and it was suddenly like every disease is one germ, right? Like each disease has one germ kind of a thing. And this disrupts that paradigm,

EAU: Oh, a hundred percent.

EW: which I find so interesting because our, the way that we approach this podcast is very much one

EAU: One germ, one disease.

EW: a thing.

EAU: Well, and it's interesting too, and we've talked about this. I wish I could remember on what episode it was, because you have both, right? You have sometimes like one pathogen that can cause so many different types of disease, like with MRSA, like with streptococcus. But then you also have one disease or one clinical syndrome like necrotizing fasciitis that can be caused by so many different pathogens because it isn't just group A strep. No, no. Necrotizing fasciitis infections can also be caused by another good friend of the pod staphylococcus reus, including MRSA, or methicillin resistant staph aureus. It can also be caused by clostridium species by Vibrio vulnificus, which we haven't yet covered, and we should.

EW: We should.

EAU: Vibrio is a marine or aquatic bacterium that can cause a necrotizing infection, especially after injuries. So like you get, you know, nicked while you're fishing or a fish scale kind of scratches you or you just go swimming when you have a bug bite or a scratch anyways. But there also are a whole bunch of necrotizing fasciitis infections that are actually polymicrobial. And these can include both gram-negative and gram-positive bacterium. So friends like e Coli or Klebsiella, in addition to all of the things that we've already in described. So whatever the organism in question, what is necrotizing fasciitis mean?

EW: Yeah.

EAU: I've said the word so many times now. It is a severe bacterial infection that starts in the skin. Usually and spreads down deep through the layers, through the dermis, through the subcutaneous fat, and into a layer called the fascia. And I wanna spend a moment to talk about our fascia.

EW: Okay. Great.

EAU: We have a lot of different types of fascia in our bodies. It is basically a part of our connective tissue network. Our fascia layers give support to various structures in our body. So just underneath our, if you think of, I'm using my finger as an example. So if you think of looking at the palm of your hand, the top of your finger being your skin, you've got your epidermis and dermis, and then you have a layer. Then you've got your subcutaneous tissue, like under

your first knuckle. And then just under that, you're gonna have a layer like under your second knuckle here of superficial fascia, and then a layer of deep fascia and then muscle.

EW: What's the purposes of superficial and deep fascia?

EAU: They're all there to support our structure. So the superficial fascia is like the under layer underneath our skin. The deep fascia is what surrounds our muscles. So all of our muscles are covered in their own layer of fascia. Our organs inside of our body also have their own versions of fascia. And then our body cavities have their own layer of fascia as well, our abdominal wall and art thoracic cavity. So we've got layers upon layers upon layers of fascia.

EW: What's fascia made of?

EAU: Mostly collagen.

EW: Oh, okay.

EAU: Yeah, it's mostly collagen. And when you look at it, it usually looks like a kind of white kind of filamentous sort of structure, almost like, I don't know a good example.

EW: like angel hair, spaghetti.

EAU: No, it's more like not quite, not quite the inside of an orange peel because it's stringier than that. Like, um,

EW: like fungal growth in the last of us,

EAU: yeah, except imagine it being quite firm, you know, and like tau.

EW: tough spider web.

EAU: Okay. Like, you know, those like cellulose um, shades that you sometimes can have on your cover, your window where like you, the sun can't get in, but you can still kind of see out or whatever. Or the sun can get in, but they can't like that. Not quite opaque. And anyways, that was a struggle. I probably should have thought of it before I started talking,

EW: I had a really, I had a really fun time guessing, um, guessing things that I have no idea what the actual image of

EAU: especially based on my hand motions, which are entirely unhelpful. Anyways, so we're talking about a bacterial infection that spreads down into this layer, and which layer of fascia Just depends on how far the infection goes, but as this infection spreads, what makes it a necrotizing infection is that the bacteria start to produce various toxins. Which one? Which type? It's all gonna depend on what the pathogen is because there can be so many, but many of the types, and sometimes it's not even toxin mediated. It's more just like this overwhelming bacterial infection. But in any case, whether it's toxin mediated or just from so many bacteria, we see a lot of inflammatory damage, including in the blood vessels of our tissues. That ends up leading to blood clots, so-called microthrombi, and that cause death necrosis of the tissue itself. Now, the term necrotizing fasciitis, that's what we're using in this. It's not an incorrect term. But what we have come to learn is that there are a lot of other kinds of necrotizing soft tissue infections. So an umbrella term that's often used now is NSTI, necrotizing soft tissue infections. Some of them get their own name, like if it's only in the skin and subcutaneous fat, you can have a necrotizing cellulitis and that would be less deep, not all the way down to the fascia if it's all the way to the muscle or primarily in the muscle. This might start from a muscle injury rather than like a skin damage. You can get a PIO myositis or a myo necrosis. My necrosis is what we see with gas gangrene,

EW: Oh

EAU: of Clostridium species.

EW: yes.

EAU: But these are not all mutually exclusive. But the reason that necrotizing fasciitis itself kind of, I think holds a lot of esteem. I dunno if esteem is the right word, but that is like the one that we think of when we think of a necrotizing soft tissue infection is in part because it's the most common. And the reason that it's most common is because the fascia has some components to it that make it particularly vulnerable to infection. First of all, the blood supply to our fascia is not nearly as robust as the blood supply to our skin, to our subcutaneous tissue and to our muscle. It is just there for support.

EW: I see

EAU: And so it doesn't need, usually as robust of a blood supply. It's not a muscle that's contracting, it's not our skin that's constantly regenerating. It's just there as like a, you know, shingles on the outside of your house. That's a bad example.

EW: those are not

EAU: what I'm saying? It's not a support structure at all. That's your skin.

EW: I have a quick question about this infection. So you talk about it going deep. What is the, it goes deep and wide, right? Like or what does it do first and in what order? And at what rates?

EAU: that is another component of the fascia itself that makes it so vulnerable to these type of infections, because once an infection gets into that fascial plane, it can spread along that fascial plane without interacting with any of the other tissue areas.

EW: Oh

EAU: it gets into that fascia, think of it like a highway now. It's just on this freeway, no stops needed. And so little blood supply that there's not a lot of things coming into carry off or to fight that infection. So yes, it is something that spreads widely very quickly. And oftentimes the first, like where that infection first started, it can't, most often it starts from something like a scratch on the skin.

EW: Yeah.

EAU: It can be a small wound, it can be a large wound, it could be a surgical wound, um, but it sometimes isn't even like a known wound to the skin. Sometimes it's damaged to like the muscle itself, right? You injure your muscle, you hid it, something like that. And there you have for some reason, bacteria that made it from your bloodstream into that fascial plane.

EW: How?

EAU: You know, because so many of these bacteria that tend to cause this infection live on our skin all the time, right? Like streptococcus can live, staphylococcus can just live on us. And so some people, every once in a while might have some bacteria that make their way into our bloodstream, and then our body manages to fight them off. Most of the time it's what we call transient

bacteremia. Most of the time you might never know that that happens. Um, but if that happens and you have an injury and these bacteria happen to make it into this fascia, they could potentially establish an infection. And to be honest, we don't fully understand like why and who, and, and all of that.

EW: Okay.

EAU: But once it's there, it can very quickly kind of spread along this fascial plane without necessarily causing more visible damage. Right. You might not see damage to the skin because it's mostly tracking along the fascia. And the final thing about the fascia that can make this particularly vulnerable is that, because I'm talking about like distinct layers of tissue, there's kind of this. What we call a potential space that exists, like think of it as like between these layers of tissue. So what part of what the fascia does is allow for things to slide against themselves, right? Like that provides support, but it also allows your muscles to slide against a smooth surface. What that means is that there is a like theoretical space, microscopic, though it may be between these tissue layers, that space can fill with fluid and it does in a necrotizing infection. And that fluid can make it even harder for our body to respond and clear that infection. 'cause our immune cells have to like wade through a swimming pool of fluid to try and get to this infection.

EW: Okay. Okay, so somehow bacteria invade the fascia.

EAU: Mm-hmm.

EW: The fascia dies fairly easily because there's it, once it erodes the blood supply, there's not a lot of redundancy, and so there's no more, like you said, highway. So then once it goes under, like along the rest of the fascia, then the tissue on top of that will just sort of die.

EAU: It can or it cannot. So sometime like eventually this infection will get so overwhelming that it will continue to invade. So it'll either invade down into the muscle or it will invade, continue going, like back up and out, back towards the skin, and then you'll see more evidence of the damage on the skin.

EW: Okay. Okay. Can we talk about the bacteria involved and what makes them more likely or toxins or the differences between them? Like why, why does this happen?

EAU: Yeah, it's a great question. And that, 'cause that's a, it's a multi-part question, right? Because it's why does this happen to certain people? Why does

this happen in certain situations and why does this happen from certain bacteria? Um, and that's a lot. I don't think I'm gonna have answers for all of those questions. Um, we know from episodes that we've done on group A strep in the past, as well as from Staphylococcus aureus, these are two bacteria that produce a lot of exotoxins. These toxins produce a really robust and strong inflammatory response in US, and that inflammation can cause damage. Um, Vibrio vulnificus, I didn't actually dig deep into it, I just know that it is quite virulent and I'm not exactly sure what all of its virulence factors are. It just means we need to do a full episode on it. Um, and then Clostridium is also like a, uh, toxin mediated infection. So it's again, this toxin and inflammatory response because of that toxin.

EW: Are the, are these the same toxins or different toxins? Is the mechanism of action different?

EAU: of different kinds. Yeah, a ton of different kinds. And a lot of these infections are actually polymicrobial. So another big component is that there are certain risk factors to who is more likely to get, and what scenarios are more likely to get, uh, necrotizing infection. Right? So individual level factors, things like diabetes, cirrhosis, or other liver disease, certain immuno compromising conditions. And the elderly are the most high at risk for a necrotizing skin and soft tissue infection. Things that are environmental, like fishing in waters that are contaminated with Vibrio. And having an open wound is going to environmentally put you at a higher risk, right?

EW: How is Vibrio transmitted?

EAU: it just gets into your skin through these open wounds

EW: right, but I mean like, where is it coming from in the environment?

EAU: It lives in the environment, it can thrive in the oceans. It's also can get to very high concentrations in filter feeders like shellfish, like oysters. So you also can get quite a severe GI infection from eating raw oysters and things because of vibrio.

EW: So it's not like our residents Staph and, okay.

EAU: Correct. Yeah. This one is like specifically environmental, whereas, yeah, most of the rest of these, even e Coli, Klebsiella, these are things that just live in us and on us, and so really it's just about the wrong time and the right

port of entry that contribute to someone eventually getting a necrotizing infection.

EW: Mm-hmm.

EAU: In terms of what it looks like, the scariest thing, there's a lot of scary things about necrotizing fasciitis. One of the scariest things is that at first it is very hard to distinguish from a totally benign skin infection. So it can look very similar to things like Erisypelas or

EW: Hmm.

EAU: There's like a few differences. Um, but at the very beginning there's not, like, there's not a lot that necessarily distinguish disease early in the course of infection. And that's where the danger really lies when it comes to necrotizing fasciitis, because the big difference is that it progresses incredibly rapidly compared to other skin infections. And by that I mean on a matter of hours or a couple of days rather than days to weeks, that we might see the progression of a cellulitis turning into a lymphangitis, streaking up your arm or an erisypelas turning into something that has, you know, a lot of vesicles or blisters or things like that. So you can imagine the nightmare, which I have seen, and it is truly a nightmare that someone comes in to the emergency room with like a red spot on, say their leg. Or maybe even just kind of like a patchy area of like discoloration or a little bit of swelling.

EW: Hmm.

EAU: You're gonna touch it or push on it to see if there's any induration or sign of an abscess. And one of the signs they teach you to look out for in medical school, school is called pain out of proportion. If you touch a necrotizing infection, that person is practically gonna jump off of the table because of how incredibly painful it is compared to what it looks like.

EW: Yes. Okay.

EAU: The other thing you can sometimes see early in the course of infection is that you might have swelling like edema that goes beyond the area of redness or of like a dark purplish discoloration. So you're like more swollen than this area that looks like it has an infection.

EW: Mm-hmm.

EAU: And then the signs that are like more classically associated with a necrotizing fasciitis tend to be pretty late stage signs, which means you might have missed a pretty critical window for intervention. But these are the things that you see a lot of pictures of online. These are like belay or the really large fluid-filled or sometimes blood filled blisters. You get a lot of bruising of the skin and you get that before you start to see tissue death, like skin death or necrosis of the skin. If you do imaging, which we often do, it'll be a CT scan or an MRI scan. Um, you might see gas in the tissues, especially tracking along that fascial plane.

EW: Where's the gas coming from?

EAU: The gas is coming from the bacteria itself as part of their like metabolism. Yeah.

EW: I thought.

EAU: You also sometimes can see this without imaging by crepitance on exam. So that's that like rice crispy feeling and sound. When you press on the skin when it gets very severe. Instead of that pain out of proportion, you might actually have anesthesia cutaneous anesthesia where you don't even feel your skin at all because so much of those nerves have died without treatment. This will progress incredibly rapidly and will then include fever, hypotension. It can progress to toxic shock syndrome. It can progress to sepsis and shock and death, and really one of the hardest parts is that early diagnosis

EW: Yeah.

EAU: The statistics unfortunately, are not great. The best ones I saw were that about 50% of the time, necrotizing soft tissue infections are not diagnosed initially on an admission in the er. But I've seen other papers that said like 85 to a hundred percent of the time, which it just seems actually bananas.

EAU: But

EW: Yeah.

EAU: yeah, it's, um, it's, it's a really, that's a really huge problem because the treatment for this is early surgical intervention,

EW: Okay.

EAU: and by early, I mean within 24 hours of this diagnosis and the earlier the better. So if, if ORs are set up to be there in a matter of hours, that person is more likely to have a better outcome than otherwise.

EW: Mm-hmm.

EAU: The surgical debridement can be really extensive. Um, the average number of surgeries that somebody needs after a necrotizing fasciitis is three to four. They sometimes require amputation depending on the location and the extent of that initial infection. Um, and even if they don't require amputation, they often require such extensive like debridement of all of that dead tissue to be able to get down to healthy tissue, that you are gonna have an open wound for a very long time in order to allow healthy tissue to kind of heal back in while you're on antibiotics to fight off that infection. may require packing changes, or it may require what's called a wound vac, which keeps like negative pressure on the wound, which can be quite painful and cumbersome. And then very often people need skin grafts or complex reconstructive surgeries to be able to heal over time. So this is something that has like a pretty long lasting impact on somebody's life if they survive.

EW: Yeah, I, I know that. Necrotizing fasciitis, we, we have fascia all over our bodies, and so it can happen anywhere. Are there places that it's more likely to happen?

EAU: Most likely places are the extremities. I think the legs, lower legs are the most likely just because that is where you have so much potential for exposure, um, to like wounds. Plus, there's such a strong association with diabetes, and so diabetic foot wounds are a place that you can really easily get a necrotizing infection.

EAU: But there are a few places that have specific names associated with them, um, because they have like a, a specific set of syndromes. So Fornier's Gangrene is a specific name for necrotizing fasciitis of the genitalia, which can be really, really horrific. Has a high mortality rate and just a huge amount of morbidity associated with it. It's often caused by polymicrobial infections. Um, but sometimes, like some of the main bacteria that are associated with it are things like staph aureus, e coli. One of the big problems with a fornier gangrene is because if it extends to involve, like near the anal sphincter or the perineum down towards the anal sphincter, then you have a really high risk, especially after surgery of fecal contamination of the wound. So it's really hard to keep these wounds from getting like reinfected. Sometimes it has to go so far, like the surgical correction has to go so far as to do like a diverting colostomy, just so

that those tissues can actually heal. So this is a major, major problem. And then there's also other areas of your body, like deep space fascia that you can get infections in. There's one called Ludwig's Angina, which is an infection of the fascia of like the submandibular space. And there's a few other like deep neck space infections that you can get that are a necrotizing fasciitis. Those are very dangerous because they could potentially involve your airway. So that usually needs emergent surgery to like decompress your airway and things like that. And then of course we talked about Vibrio nec fasc, which is a little different than our classic streptococcal nec fasc. There's actually a, they classify it into like, type one is the polymicrobial infections, type two is streptococcus or staph aureus. And there's some people that are like, we should have a type three for VIO plus or minus Clostridium. I don't know if that's like official yet, but um, and that is what we see in association with marine life or like marine coastal waters, that kind of a thing. So

EW: subtropical, tropical, coastal waters

EAU: not anymore because of climate change. We'll talk more about

EW: I mean, the water is warming. Yes.

EAU: exactly, yes, yes, it likes warm water.

EW: Mm-hmm. Mm-hmm.

EAU: Um, but yeah, I mean, I don't know. Erin, if you have more questions, that's like the main thing that I have. I have more on like how we diagnosed it than that, but it's probably a little bit boring. And so tell me if you have more questions. Otherwise, I wanna know what you know about how we got here.

EW: I mean, I guess most of my questions now are probably more epidemiological, like, have we gotten better? Where is this happening? What, you know, what advancements are there? Potential advancements? Will AI help us diagnose

EAU: That's a fun question. I don't have an answer to that, but that's a fun

EW: Not that AI is the end all be all, but I feel like for diagnostic stuff, it is an interesting

EAU: It is, especially, especially for radiology. Diagnostics. Um, and that is a big, really, like a lot of what research needs to be done is on how to better diagnose this quickly. Right? And in the early stages of infection.

EW: Okay, so maybe that's a question. How low can we get mortality down if we catch it early enough, and what does that early enough

EAU: We can get it down. We, at least in the studies where they have looked at this, which have their own sets of biases because they're like, you know, only looking at the things that they have diagnosed. And, you know, so it's, there's nuance there, but at least in the studies that have looked at this, average mortality is like 25 to 35%. And in the studies that have tried to compare early versus delayed debridement, early debridement can get it down to as low as close to 10%. The biggest problem is those are all in studies where that has been identified, right? And so the, the question is like, how do we get better at identifying those ones that we missed, who we sent home with antibiotics and then they came back and now they have an necrotizing infection. So that's the tricky part. Um, and we don't have great answers for that necessarily.

EW: Right. Hmm.

EAU: Erin,

EW: Erin?

EAU: I know these bacteria have always been here,

EW: Sure.

EAU: but tell me about the necrotizing infections. Oh, do I wanna know? I do.

EW: I think you do. I think you do. Okay.

EW: Antibiotic resistant bugs aside, which I know is like a big thing to put aside. There are relatively few, I would say, bacterial infections that have the power to transport us back to an era before we had any tools to fight these germs. Right.

EAU: No, it's, I mean, necrotizing infections are terrifying.

EW: Terrifying. And what I mean is that even in the most well-equipped hospital with the most skilled, specialized, infectious disease docs, surgeons, whatever, modern medicine is sometimes powerless to stop the ravages of necrotizing fasciitis, regardless of the bacterium that's causing it. It is destructive, it's deadly. It's humbling in the way that it rejects the hundreds of years of scientific advancements that we've made in so many areas of medicine.

EAU: Yep.

EW: I understand why nicknames like.

EW: Quote unquote galloping gangrene or flesh eating bacteria. I understand why those are frowned on by the medical community. They're sensationalist, they're stigmatizing, they're imprecise, and they can incite undue fear and panic that this new deadly disease, like something out of a horror novel is about to strike you down and everyone else in your family or community, because that's not the way that necrotizing fasciitis works. But I think that those names sensationalists, though they may be also convey the genuine fear that comes with being largely powerless in the face of this deadly disease.

EAU: Yeah.

EW: And I think it could also be argued that they have helped raise awareness of the disease and since time is certainly of the essence that could maybe have saved lives in the past. Still let's, we're sticking with necrotizing fasciitis for this episode. Or soft, what is it? Soft tissue necrosis, necrotizing infections. Okay. The words are all a jumble. Yes. Um, so I've got a quote for you and strap in. 'cause this is the first of many, many quotes, quote, "few entities challenge the surgeon's clinical and operative skills as intensely as devastating necrotizing soft tissue infections." End quote,

EAU: Yep.

EW: that statement, although it was written in an article from 1991, necrotizing Lesions of Soft Tissues, A review by Patino and Castro. That quote is still as relevant today as it was 34 years ago. And in fact, a paper written 18 years later in 2009 reported that over the previous three decades. So from. 1979 to 2009, mortality from necrotizing fasciitis had not budged despite better tools and more knowledge about the condition.

EAU: Yeah. I am not surprised by that, unfortunately.

EW: I know, I know, and I'm not saying this to like terrify everyone and say, let's jump on the catastrophizing train. Just that we're still figuring it out. Modern medicine is still figuring it out and we have been working on it for centuries.

EAU: Yeah. We'll get to later how rare these are. They're

EW: Yes. They're quite rare. They're quite rare. Yes. Not historically, um, in certain situations. Yeah. So when cases of an unusually virulent strain of group A strep began popping up in the mid to late eighties, the question was raised, is this something new? I don't know how sincere of a question that was, although I did read one article that was titled Flesh Eating Bacteria, A New Disease or Old Story, because a quick review of the literature shows that the answer is that this is a very old story. Let's bring out some Hippocrates, right. Fifth Century, BCE Volume, one of epidemics, quote, "many were attacked by the erysipelas all over the body. When the exciting cause was a trivial accident or a very small wound, the erysipelas would quickly spread widely in all directions. Flesh, sinus and bones fell away in large quantities. The flux, which formed was not like pus, but a different sort of putrefaction with a copious and varied flux. Fever was sometimes present and sometimes absent. There were many deaths. The course of the disease was the same to whatever part of the body. It spread. Many lost the arm and the entire forearm. If the malady settled in the sides, there was rotting either before or behind. In some cases, the entire thigh was beared or the shin and the entire foot. But the most dangerous cases of all such cases were when the pubis and genital organs were attacked." End quote.

EAU: The way that that fluid is described today is called dish water fluid. It is like, it's not a puss, it's not a purulent infection. It's like, um, a very liquidy fluid that's kind of foamy and looks like that grayish, um, after you've washed dishes.

EW: Yeah. Uh, it's horrific. Yeah. Um, yeah, it and, and that quote though, like, did that sound to you like necrotizing fasciitis? I mean, absolutely. Right. Like, definitely.

EAU: Yeah.

EW: I think that this brings to light. One of the unique or interesting compo like facets of necrotizing fasciitis is that finding historical traces of necrotizing fasciitis in like medical text requires much less guesswork because it's symptoms and clinical course are so distinctive, right? It's not like there's a fever and maybe a rash and some malaise and maybe a sore throat, and like maybe your head hurts. You know, it's, it's, it's necrotizing fasciitis, whether it

goes by necrotizing fasciitis or malignant ulcer, or a gangrenous ulcer. Putrid ulcer, uh, phage, edina, uh, phage, denic, ulcer phage, Edina gang OSA or hospital gangrene. All of the, whether it's called any of those things, the description will pretty clearly point towards necrotizing fasciitis as the culprit. And so, digging back through the medical literature, we can find traces of this condition dating back at least to the late 18th century in France, where a doctor at a hospital for the impoverished described it. And it was also mentioned in an 1804 book on nautical medicine where it was thought to be newly emergent in the British "homeseas", quote unquote, mostly appearing in those who had returned from long cruises in warm regions. Um, I don't think it was new, but I think, like you said, it was rare. And so it was like, how widely known was it? Anyway, so I've got a quote for you. From this, this nautical medicine book. " In the summer of 1799, the malignant ulcer made its appearance onboard the Tere with all the characteristic symptoms in virulence, which marked it in other ships. Every wound, abrasion of the cuticle, blistered part, scald, or burn, passed rapidly through the various stages of inflammation, gangrene and spaceless. In a few days, leaving the bones almost bear from the separation of immense sloughs." End quote.

EAU: Ooh, Erin.

EW: Yep. Uh, the ship, the Saturn seemed especially unlucky when it came to this disease, and there was one case in particular that is truly horrific, like historically horrific. So while in port, the sailor had contracted gonorrhea and it just kept getting worse, like the inflammation kept getting worse. The, the, the everything kept getting worse.

EW: If you're squeamish, you may want to pause here or skip ahead. Yeah.

EAU: like a 30 seconds. Maybe

EW: I mean, you've turned, you've tuned into an episode on necrotizing fasciitis, so like it's a little bit of a Yeah. Yeah. Here we go. Quote, "the symptoms advanced by too hasty strides to be arrested by any resources of medical skill. The gland of the penis soon dropped off, but the misery of the patient did not stop there. The whole body of the penis passed quickly through the stages of excessive excitement and inflammation to complete gangrene and mortification, and separated at its very crura. The whole length of the urethra to the bulb sloughed away, and also the scrotum leaving the testes and spermatic vessels barely covered with cellular substance. He died." End.

EAU: Of course. Of course. He died.

EW: course he died.

EAU: How to have to live through all of that, and then, oh my gosh.

EW: Uh, and then literally like the next sentence, the author says, cases like these have been frequent on board these ships, and I don't know what these means. Does it mean like penis is falling off or does it mean like

EAU: Necrotizing infections in

EW: ulcer? Yeah, right. Okay. There's more. Um, I try, I, yeah. So there's another book published in 1818 on the subject called Observations on Phage, Dina Gang Osa by HH Blackadder, that discusses the condition as though it was well known, at least to military surgeons. So there's a passage from that book that is basically an echo of the quote that I read earlier, quote. "Gangrene Fadina is one of those diseases which happily, seldom falls under the observation of civil practitioners. But on the other hand, it is one of those which army and navy surgeons during a time of active hostilities are frequently called upon to resist with all the resources of their art. No disease requires more circumspection and personal attention on the part of the surgeon, and when the circumstances in which it occurs, the occasional rapidity of its progress, the extent of its ravages and fatal tendency are considered, it may justly be esteemed, one of the most dreadful diseases to which mankind are subject." So he is like, this is, this is the worst.

EAU: Yeah. This is it.

EW: He also talks about how important it is to recognize this disease quickly. Quote, "where there is any, even the smallest reason to dread the occurrence of this disease too early or too many precautions cannot be taken with the view of securing its speedy detection." End quote.

EAU: Mm-hmm.

EW: Um, I think it's like it's, that was from 18. 18. And so, uh, yeah. It's just,

EAU: They knew all the way back then how important it was to be quick about it.

EW: yeah. Yeah.

EAU: trouble with that.

EW: we are, we are, and it's, I mean, It's hard. It's hard. Um. I'm also like, this person's not like prophetic by any means. Right? Like, I, I'm cherry picking these, these quotes. He also used arsenic to treat it and he blamed the weather for when it showed up. Um,

EAU: Uh, maybe they were all Vibrio

EW: maybe, yeah. I mean, but the, I think the thing that I, I appreciated the most about that entire, like, I didn't read the whole book, but in the introduction, he, one of the things he says is "the author is fully aware of his defects" to kind of like, head off any criticism. He's like, I know. Yeah, I know. I was like, we're gonna start every single episode like that from now on.

EAU: Yep, yep, yep.

EW: Um, but so throughout the rest of the 18 hundreds, more case descriptions followed often though not always associated with some sort of military or nautical endeavor, in which cases it may have been more contagious rather than the sporadic cases that are seen in the general public. And once you saw it, you never forgot it. A surgeon named John Henin said in 1820, to those who have seen it once, a glance at the Soar or even the smell of the ward will immediately discover it. It can scarcely be confounded with any other disease or any other species of ulcers. End quote. Um, yeah, distinctive.

EAU: Yeah.

EW: Most scholars put the next big event in the history of necrotizing fasciitis in the aftermath of the American Civil War. When medical officers such as Joseph Jones, who was in the Confederate army, described some of the horrors that they witnessed. Jones is often, uh, credited with providing the first modern description of necrotizing fasciitis, which he referred to as hospital gangrene.

EAU: Hmm.

EW: Quote, "in some cases, the progress of the disease is rapid and terrible. The edges of the wound become hardened and averted. The surface of the wound rises up into a pulpy, ragged gray and greenish mass. When the sloughs are detached, the disease attacks other adjacent structures from day to day, extending its ravages, both in length and breath. Most commonly, after the muscles have been exposed, they continue to be gradually dissected. Their connecting membrane is completely destroyed, and they are left covered with an offensive, greasy looking matter. As the disease advances, hemorrhage from

small vessels is a common occurrence, and in the more advanced stages, some of the large vessels give way, and the patient is frequently destroyed by the consequent hemorrhage." End quote.

EAU: Hmm.

EW: Yeah. Yeah.

EAU: Truly, I mean, I flesh eating bacteria is not a term that is like nice to hear, but it is. I understand how it got that nickname. Like it is what it feels like, what it looks like, you know?

EW: I mean, that's what it was like phage, Idina was eating away like that. It, it is a dis, it describes what happens. I think it's also, like when it was happening in military hospitals, it's possible that there were like outbreaks where it was contagious because you had a bunch of group A strep in that hospital and horrible sanita, you know, sanitary conditions. And so it spread. But like that, I think that is sort of the, what conjures today that idea of like, flesh eating bacteria is gonna, it's gonna spread, it's gonna get me, and it's not, that's not the way that it, it works. Yeah.

EAU: Yeah. Hospital gangrene is also quite a misnomer for today's infections. It's usually not at all hospital acquired.

EW: right. Uh, definitely. That was like, it probably should have been military, hospital gangrene. Yeah. And Joseph Jones. This guy, he was more than qualified to describe this disease. Over 2,600 cases of hospital gangrene had been diagnosed in soldiers during the American Civil War. Nearly half of whom died. That's a lot.

EAU: Holy guacamole.

EW: Yeah. Yeah. And those who lived like the, around the half of those who lived, they recovered, but they did so at the cost of limbs or multiple limbs, which had to be amputated. And in a different book, Jones recalls the first case of hospital gangrene that he observed. Which was in a young man, a volunteer from Florida who was stabbed in the scrotum, not during battle, but during a fight at the Drinking Saloon.

EAU: Oh no.

EW: Yeah, I know. So he was brought to the hospital eight hours after being stabbed, and he died less than a week later. I decided to, to, after reading through the full description, I was like, I'm actually not gonna quote all of this, so I'm sparing you the full description. Um, and also it involves that another penis sloughing off. But there's a part that really stuck out to me at the end. Quote, "the patient retained his senses to within a few moments of death and was at no point restless, no active pain was suffered, and the patient appeared to be insensible to his distressing condition. He expressed no fears of death, did not complain of the horrid stench, and although fully warned of his true situation and informed that every hope of life had vanished, he actually traded for a watch two or three hours before his death." End quote. Isn't that heartbreaking?

EAU: Absolutely heartbreaking.

EW: Ugh. Um, yeah. And so to round out the, this discussion of historic necrotizing fasciitis, and especially as it applies to the genitals, I have to mention fornier and the gangrene that bears his name. So in his work, he was a, uh, quote unquote ologist. So he studied sexually transmitted infections, and in 1883, he described five patients with necrotizing fasciitis in their genitals and, uh, peroneal region. I wasn't sure why this got a separate name, like why is this, unless it's just, that's where it happens more frequently. Like why?

EAU: That's just what we call it when it's there.

EW: okay. So it's just sort of like, almost like a historical, like relic in that way.

EAU: I, as far as I know, I mean, the same thing with like ludwigs angina is in a specific location, so it's like to describe the, like, location of where, of where it is, but it, it is an necrotizing fasciitis of the fascia of that area.

EW: Right. Um. So, until germ theory was fully established, people really did not know where hospital gangrene came from or how to treat it. Like Jones thought it was the crowded conditions and poor ventilation in the hospitals. Um, another surgeon pinned it on scurvy and nutritional status. Uh, there's the guy who thought it was about weather. Thomas Trotter, who was the author of the 1804 book on nautical medicine, he pointed out over and over again to alcohol. Like every case that he described, he was like, and this person drank this cheap alcohol and this person drank this cheap alcohol. Once people were able to identify the causative bacteria in the wounds, that didn't necessarily clear things up right? Like we're, we're still, uh. At a disadvantage because it was, it was also turning out to be multiple different microbes, just a mix of them

sometimes. And interest in the condition. Though I found this fascinating, seemed to fall in the late 18 hundreds, early 19 hundreds. Like it was like kind of like this was a big deal. Rare treatises about it. And then it was kind of like, eh. And there was a physician who wrote in 1908 that quote, "hospital gangrene so-called, has been in years past the terror of military surgeons and camp hospitals. It has almost completely disappeared from observation and is now practically never seen." End quote. Isn't that interesting?

EAU: Yeah, why? What changed?

EW: Dunno. So there is a, a thought, do you remember when we talked about strep last and we talked about this sudden decrease in, and I'm wondering whether it was like in scarlet

EAU: shift. Yeah. So all of a sudden we have ones that, whatever, whatever toxins they're making are not the ones that are more likely to cause an necrotizing infection. Maybe. That's super interesting.

EW: yeah. So it could be that, I

EAU: I should have looked specifically at that, but I didn't.

EW: There was a paper that that mentioned a little bit of that, and there was ano also another paper that looked at genomes of the group A strep today, and sort of any sort of shifts in that as well. And I didn't get into the nitty gritty of it, but like it does seem like there could be, like the biology is there for these types of shifts.

EAU: plausible explanation.

EW: It is. Yeah. Yeah. Um, but yeah, that, that whole, oh, it's never, it's a disease of the past. So it was a little bit of a premature celebration. Uh, the disease continued to pop up both in times of war, like in World War I and in the general public. Just another times like the outbreak that involved at least 20 cases in China, which was reported on by a physician named Frank Melanie in 1924. And so this actually, his description marks the first 20th century description of the disease where he also linked it to particular organisms, uh, group A strep, namely. Yeah. And then in 1951, hospital, gangrene, malignant ulcer, Fadina gang Noosa, whatever else it was called, it was rebranded as necrotizing fasciitis. And this was a name chosen by physician Ben Wilson. Quote, "because fascial necrosis is the most consistent manifestation of the disease end quote." Yeah. And in this landmark paper he went through what

was known about the course of disease causes, treatment, outcomes, and epidemiology. You know, essentially boiling down to rare but not unheard of time is of the essence. Case. Fatality rate is lower than in past decades, thanks to early recognition surgery and, and antibiotics. Yeah. Uh, and so while the condition was known in medical circles, rare though, it was, I think again, as we talked about, uh, memorable, rare but memorable. It was known from at least the mid 20th century. It escaped public attention until around the 1990s. And this is, I, I would say largely that's a generalization, but that's around the nineties is when a series of cases received a ton of media attention. There was one outbreak in particular in, uh, a place, I'm, I'm going to say this wrong, uh, Gloucestershire involving at least seven individuals, and it led to headlines that were like, hospitals get warning on killer bug. Mystery Bug kills three more flesh eating bug kills Young Mother, I watched Killer Bug eat my Body. You know, things like super sensationalist headlines, right? And

EW: so,

EAU: monsters inside me kind of a thing.

EW: yes, even though that is partially where I got the interest in parasitology, um, but this also, it seemed not like shared exposure, but more like coincidence that these people were getting necrotizing fasciitis. But any factual reporting of that, or ex exploration of that nuance that got drowned out by these sensationalist headlines and fear-mongering. But like I pointed out at the top, there might have been the positive effect of improving recognition. You know, just like knowing what it is and that it exists, right? And sure enough, it was interesting to see that following this reporting countries around the world began to also report, like release reports on necrotizing fasciitis at higher rates than previously seen in cases, often following like a surgical procedure. And so this might have helped, uh, people, whether in the community or physicians, recognize some early warning signs in themselves or their patients. But there is also a cost, of course, to this type of reporting. It contributes to the stigma that many people who recovering from necrotizing fasciitis face, you know, the way that we talk about disease, even legitimately scary ones like necrotizing fasciitis. It, it really does matter. But, um, yeah, that's, that's all I have for the history of nec fasc. So Erin, why don't you tell us what's happening with this condition today?

EAU: All right. I'd love to.

EAU: today? Thankfully, necrotizing soft tissue infections, including necrotizing fasciitis are relatively rare. However, we don't have great numbers

on them. So group A strep infections, like invasive group a strep infections, which includes necrotizing fasciitis, but also includes other types of infections. Those are reportable in the US so we know that their rate tends to be about 0.4 per 100,000 in the us, but group A strep only accounts for a proportion of necrotizing fasciitis or necrotizing soft tissue infections more generally. And what proportion, I don't know. We, I, from what I can tell, the scientific community at large, the medical community doesn't necessarily have a great handle on that. What's very interesting is that I read one paper, which I'll link to out of China, that was quite recent, that looked at in their hospital system, just in one small part of China, and they had hardly any group a strep in that particular population. So I think it really varies location to location. Maybe it does vary based on, you know, what serotypes are most prevalent, what toxins are being produced, et cetera. But across the board papers that tried to estimate the incidence of just necrotizing fasciitis, regardless of the type or the causative agent in the us, it's estimated at like 8 to 10 cases per 100,000 individuals. And it really can vary geographically across the globe from like less than one per 100,000 in some studies in some parts of the world to 20 cases or more per 100,000 people in other parts. I will say that if you dig deep in these papers, some of the studies that are reporting those higher end numbers are citing how many cases there are per hospital admission, not how many cases there are per general population, and that's gonna be quite inflated,

EW: right.

EAU: but in any case, it can really range. What unfortunately doesn't have as huge of a range is the mortality rate, and that's remains quite high. Some studies report a mortality rate as high as 40%, and so in particular studies or in particular areas, the mortality rate can really be quite high. But on average, globally for the last, like you mentioned, Erin, 20 plus something years, it really hasn't changed. The mortality rate on average is between 25 and 30 or 35%. It's only in the last couple of years that we've seen studies more often reporting rates closer to 20%. So we're seeing maybe some suggestion of a bit of a drop.

EW: Okay.

EAU: Like I mentioned, some of the studies that are just looking at treatments, so they're looking at kind of a, a more well-defined population. It's not these like larger retrospective studies and things like that, but some of these papers suggest that we could be reducing mortality rates to 10% with correct identification and access to surgical management. But that is still really high. A 10% mortality rate is terrifying. And that's the lowest that we've been able to get it in studies.

EW: Yikes.

EAU: I know. And what is scary, and I don't wanna necessarily be fear-mongering about this because again, this is still quite a rare disease, but it does seem to be increasing in number.

EW: Yes.

EAU: Um, so according to analysis that was published, I think in 2023 from CDC data that went from 2003 to 2020,

EW: Okay.

EAU: there was an increase.

EW: Oh, I saw this paper. Yeah.

EAU: There was an increase of like 120% of deaths associated with necrotizing soft tissue infections, despite the fact that like we are, at least in theory, getting better at treatment. Right. Or at least not getting worse. So deaths went from 824 in 2003 to 1,842 in 2020.

EW: Is there any difference in, uh, like diagnostic or reporting or anything like that? Or is that simply just the number of cases?

EAU: It's a really good question. As far as I know, there's not any differences in, you know, reporting or things like that. 'cause there hasn't been a change in like what's required to report versus what's not. This is all just still like they've gathered this data after the fact. It's not necessarily like, it's not as easily accessible even. Um, I would say we are. And I don't have necessarily data to back this up, but I would hope that we are getting better rather than worse at detecting it because of advances in things like CT technology, um, there's a lot of people interested in using things like ultrasound to better identify. It's still a little bit tough right now. Um, but there's certainly a lot of, and there's also a ton of these different scores that people use like laboratory values to try and say, if I'm not really sure, you know, should I call surgery or should I not? There wasn't anything clear on imaging. There's like these scores that you can calculate to try and lean you more likely necrotizing versus not. None of them are perfect, but there's a lot of interest in like, how do we better identify this early? And yet we're still seeing this increase in deaths and without a corresponding increase in the mortality rates. And so I do think that this is due

to an increase in cases from, from everything that I can tell. The other thing that we know there is an increase in is cases of Vibrio vulnificus specifically.

EW: Right.

EAU: These wound infections between 1988 and 2018, Vibrio wound infections increased eightfold and also shifted northward substantially. And we think that this is down to climate

EW: change.

EAU: Vibrio has actually, and I, this was a new fact for me, it's been called a microbial barometer of climate change because of how well it thrives in this warm brackish water and how highly sensitive it is to temperature.

EW: I've heard that. Yeah.

EAU: Yeah. And so we, when we combine all of this information, plus the fact that we have an increasingly elderly population who are already at risk of necrotizing infections compared to younger populations, um, it's kind of a scary possibility that things could continue to increase Vibrio and otherwise. Um, but at this point, at least it is still rare. That's the only good

EW: Silver lining. Yeah. Yeah. It's not really a silver lining.

EAU: Yeah, that's necrotizing fasciitis, Erin.

EW: Wow. Uh, I, I, I don't know how to react. I mean, there's, I I, it's horrifying.

EAU: It's horrifying. And I, it is a truly horrifying disease, and I also, it's a, it's a tough balance to not feel like, like those headlines that are like, oh my, you know? Um

EW: I mean, I think, and I, I think you're right. And I think it's like, it's a hard balance because I think it's really important to be vigilant and like, what, what are things? How do we worry without worrying constantly? Like how do we worry about the right stuff? I don't know the answer to that.

EAU: Me neither.

EW: Yeah. And I don't think the papers that we're about to guide you to, we'll have the answers to that E either. So,

EAU: But they are great for reading more.

EW: great transition. So I have a bunch I'm going to shout out to in particular. One is by, uh, Loudin published in 1994 in the Lancet titled Necrotizing Fasciitis Hospital, gangrene and Fadina. And then another is by Quirk and Sternbach from 1996. I was digging the nineties papers for this. I think there was a lot of interest. So a lot of papers, uh, that, and this one was titled Joseph Jones Infection with Flesh Eating Bacteria from the Journal of Emergency Medicine.

EAU: I had a bunch of papers, a few that I particularly enjoyed. Um, I was a, 2017 was my, was my year Erin 'cause one from infectious disease clinics in North America from 2017 was titled Evaluation and Management of Necrotizing Soft Tissue Infections by Bonnie and Cadre. And then another from 2017 from the New England Journal of Medicine by Stevens and Bryant called Necrotizing Soft Tissue Infections. Um, I had a bunch more, you know, from the last decades. You can find 'em all on our website. This podcast will kill you.com under the episode tab. Check it out.

EW: Thank you again, Maggie, so much for sharing your story. I'm Oh, horrifying. Harrowing.

EAU: Yeah. Thank you. So thank you so much. We, we can't say it enough.

EW: Thank you to Blood Mobile for preventing the music for this episode and all of our episodes.

EAU: thank you to Lianna and Tom and Brent and Pete. And my Jessica and my, everyone. Everyone, exactly right. Thank you.

EW: Thank you to everyone, and thank you to our listeners who are, you know, make us or let us make this podcast. Words are failing me and to our patrons who support truly means the world to us. You are amazing. Thank you. Thank you. Yeah. Well, until next time, wash your hands.

EAU: You filthy animals.