Vital Signs: A Lethal Scratch

02.01.1998

Mrs. Anders didn't seem sick. But the fiery streak up her ankle was a poisonous calling card.

by Tony Dajer

“This leg is hot, doc,” the ambulance medic whistled. “Scratched the bottom of her foot three days ago. A nick. Nothing.” He threw up a perplexed hand. Mrs. Anders, a 35-year-old black woman, brooded in her wheelchair. Vexed at the absurd injury that had landed her in the emergency room, she just wanted her leg to get better so she could go home to her three kids.

“Go to it,” I told Kevin, my physician’s assistant student.

Kevin was a star, the kind of PA student who sometimes makes medical school seem overrated.

“Get the history, examine her, then tell me your plan,” I told him, unnecessarily.

Ten minutes later he crisply read out of his little spiral notebook, “The patient scratched the bottom of her left foot three days ago. Can’t remember what on. Yesterday it began to hurt and swell. Last night she felt feverish. Except for a history of depression, she has no other medical problems. No diabetes, no prior leg surgeries, no nothing, really. Her temp is 104.6.”

“Whew,” I exhaled.

“On exam,” he continued, the left foot and ankle are red, hot, and tender.”

“Any other findings?”

“None.”

“What do you think?”

“Cellulitis of the left ankle and foot. Needs antibiotics.”

A superficial skin infection, cellulitis is both common and generally easy to treat. The usual causes, staph and strep bacteria, respond to oral antibiotics. Doctors prefer to treat both because it’s difficult, clinically, to distinguish them.

“Sounds good. Let’s take a look,” I said.

The foot and ankle glowed a dusky red. But Mrs. Anders still had her pants on.

“How far up did you look?” I asked Kevin.

“Ohops,” he replied. Not far enough.

I smiled at Mrs. Anders and drew the curtain.

“We’ll need to take these off, I’m afraid.”

“Okay,” she answered neutrally.
We helped her slide the slacks off. And there, tracking up the inside of her leg like a battalion of fire ants, was an inch-wide streak of red.

I pointed: Lymphangitis. Classic sign of strep infection. The bug uses the lymphatic system like a highway. This infection has advanced well beyond her ankle. She needs intravenous antibiotics.

"And I should have picked it up," Kevin lamented.

The lymph system is the complex network of vessels that carries waste products from the tissues back into the bloodstream. These vessels also carry foreign material to the lymph nodes to help promote an immune response against infection. The worry with strep infections in the lymph system is that they can linger in the vessels, causing local destruction before the immune system can be alerted to launch an effective defense. Alternatively, if strep passes out of the lymph system and invades the bloodstream, it can cause catastrophic illness without much local infection. In Mrs. Anders's case, strep was on the march and we would have to hurry to head it off.

Streptococcus bacteria, the cause of everyday strep throat, is among our most ancient, tenacious, and versatile bacterial enemies. Strep strains linger in the soil and on our skin, and their tricks are legion. Some can incite surface infections like strep throat and erysipelas. (The word erysipelas—Greek for red skin—refers to a more severe skin infection than cellulitis.) In other cases, they can invade lungs, heart valves, and spinal cords. A great opportunist, strep rampaged through nineteenth-century maternity wards as puerperal fever thanks to doctors who examined new mothers with unwashed hands between cases. Before penicillin, untreatable strep throat caused lethal epidemics of rheumatic fever via an evil biochemical mimicry. The strep provokes an antibody response that mistakes the sufferer's own heart muscle and valves for the strep intruder.

Most recently, strep reared its hydra-like head as flesh-eating bacteria. Headlines hyped it as a new plague, but 2,500 years ago Hippocrates described an erysipelas that led, gruesomely, to flesh, sinews, and bones falling away in large quantities. This horrifying condition is caused by strep strains that slip into tissue following an innocuous scrape or cut. If the infection is not treated, the bacteria can crank out enough enzymes and toxins to literally dissolve flesh. Strep enzymes can dismantle connective tissue, blood clots, and other living firewalls in its path. Strep toxins sabotage blood vessels and cell membranes, dropping blood pressure and flooding organs with oxygen-blocking cellular sludge. So efficient and tailor-made to humans are strep's tools that in one of biology's great ironies, we now use the enzyme streptokinase as a clot-buster to open clogged coronaries and save tens of thousands of heart attack victims a year.

Finally, this bacterial version of a Swiss Army knife kills because it is quick. Once it clears a beachhead, it can move at almost visible speed, as it had on Mrs. Anders's leg. The nastier strains of strep secrete flesh-chewing toxins, and if the infection progresses, patients can suffer the horrendous loss that Hippocrates so accurately described. The destruction of flesh is even more terrifying because it can commence without much evidence of poisoning on the surface of the skin.

"So what do we give her?" I asked my still-chagrined PA student.

"Cellulitis can be caused by staph, strep . . ."

"Usually," I cut him off. "And you need antibiotics that cover both. But," I deepened my voice and harrumphed, "this is classic, absolutely classic strep lymphangitis. Only strep behaves in such a fashion. Your patient requires penicillin. And in large doses. So fire away."

In keeping with its particularities, strep, in this era of antibiotic resistance, has remained exquisitely sensitive to that granddaddy of antibiotics, penicillin.

"A million units?" Kevin asked.

"Her temp is over 104, the strep is galloping up her leg," I replied. "Let's say 2.5 million."

All that remained was to call the admitting team and get Mrs. Anders upstairs. I let Kevin do it.

"And emphasize to them it's strep and she needs penicillin."
“Right.”

We moved on to other patients. An hour later, I buttonholed Mrs. Anders’s admitting intern, Carol Fields.

“Amazing lymphangitis, eh?” I asked. “You won’t see many as clear-cut as that. How much penicillin did you give?”

She squirmed.


+++ 

Cefazolin is distantly related to penicillin; both muck up the bacterial cell-wall-building machinery critical to cell division.

What Cefazolin has over penicillin is its resistance to staph’s penicillin-chewing enzyme, penicillinase. But against strep, penicillin leaves Cefazolin in the dust, clobbering the bug at concentrations of only ten-millionths of a gram per liter. As horses, Cefazolin would play Clydesdale to penicillin’s Thoroughbred. And in Mrs. Anders’s case, we had a lot of lost ground to win back.

“But it’s classic strep,” I said, flipping my hands up in supplication. I pulled out Rosen’s, the emergency medicine bible.

“See, right here, ‘streptococcal ascending cellulitis.’ This is a carbon copy of your patient.”

“I know, Dr. Dajer [DIE-er], but I’m only the intern.”

I headed off and snagged the resident.

“Look,” I began, “normally I’d agree with you on the Cefazolin for added staph coverage, but this is strep. The trivial entry wound, the lymphangitis. It all adds up. She needs pen.”

“We’ll stick with the Cefazolin for now, thanks,” he replied in a tone that dripped “This is routine, it’s only strep or staph.”

Every week, medical journals plug newer and broader-spectrum antibiotics. The temptation to believe in the latest sawed-off shotgun is fueled by tens of millions of dollars in annual drug company profits. And strep, still quaintly sensitive to penicillin in an era of mega-resistant, armor-plated bacteria and implacable viruses, seems a pushover, a has-been you can practically pick off with a slingshot.

“Broader isn’t deeper. Pen is the drug of choice,” I persisted.

The resident smiled stiffly. He was busy. “It’s what our attending wants.”

I gave up. I couldn’t prove it was only strep, because lab cultures take two days. Moreover, medical etiquette demanded I pass the baton to the admitting team.

Next morning I sent Kevin up to check on her.

“She looks better, he reassured me. “Fever’s down to 102, and she says it hurts less.”

“Ah well,” I sighed. “So much for the classics. She looked sick when she came in. I’m glad they were right.”

On the second morning, Kevin needed no prompting to run upstairs. When he came back down, the look on his face chilled me to the heart.

“I don’t think she looks good,” he said with an urgency I’d never heard him use before. “The medicine team says in its note
she's better, but her temp's back up to 103.6 and the leg looks terrible.

+++ 

I sprinted up the stairs. At each landing my brain pounded with the thought, “Christ, two days. Two days wasted.” Mrs. Anders’s only reply to my out-of-breath “How are you?” was a moan. The leg had swollen enormously and taken on an ominous purple hue. Small, evil-looking blisters puffed across the skin. I feared tissue necrosis, the beginning of catastrophe.

Once strep succeeds in penetrating deeper tissue layers with its cutting and liquefying enzymes, a chain reaction begins: muscle cells killed by strep release potassium, phosphate, and other cellular by-products that poison adjacent muscle. Strep feasts on the remains and oozes new waves of deadly toxins. At that point the only hope for survival is to flay open the limb and excise wide swaths of flesh.

But even with drastic surgery, strep can outstrip its pursuers. Patients can lose not only swaths of skin but limbs too.

Carol, the intern, sat at the nurses’ station jotting down lab results.

"Your patient is worse," I announced bluntly.

"But the resident said her white count was down and she looked better," Carol replied.

Then she held up a lab slip and said, "Why do you suppose her PTT is up?"

The PTT, or partial thromboplastin time, is a measure of how well the clotting system is working: the higher the number, the poorer the function. The test involves taking a bit of blood, adding in a clotting factor, and measuring how long it takes for a clot to form. Mrs. Anders’s result hinted at a battle in her blood. Strep, in addition to killing tissue directly, can secrete toxins that can wipe out kidney, lung, and coagulation function, for starters. Now my alarm bells whooped.

"Because she’s in the early stages of toxic shock or tissue necrosis or both," I wanted to shout. Instead I said, "You are to give her 3 million units of penicillin right now and call an infectious-disease consult. Stat."

"But I can’t do that," Carol replied. "It’s up to my attending."

"Do it and I’ll deal with your attending," I said with heat.

The trick to medical argument, paradoxically, is to sound absolutely sure of yourself, though it’s a state achieved only by the deeply ignorant. I called the attending.

"Dr. Moore, this is Dr. Dajer. I admitted Mrs. Anders from the ER. Her leg looks much worse to me. I’d like to have the intern start high-dose penicillin and call an I.D. consult. Her PTT is up. She may be in the early stages of toxic shock or tissue necrosis."

"But she looked better this morning," Dr. Moore stammered.

"But much worse than she did two days ago," I insisted.

"Shall we see what the I.D. consult says?" she temporized.

"Yes, but we should start pen now."

"I'd rather wait." Medical convention says that cellulitis is easily treated with Cefazolin, and Dr. Moore was sticking with convention.

"Fine," I said, then rang off. I turned to Carol.
"Give her the penicillin. Don’t worry, I.D. will agree."

The infectious-disease specialist was somewhat startled by the stat consult in a field that usually counts hours or days, not minutes, in the onset of disease. But she took one look at Mrs. Anders’s leg, upped my penicillin dose, and added Clindamycin. For strep has another trick: once it has reproduced in large numbers, it more or less stops multiplying. At this stage cell-wall monkey wrenches like penicillin aren’t as effective because few new bacteria and new cell walls are being made. Clindamycin tackles this phase by directly inhibiting the bacteria’s protein-making life-support systems. Moreover, toxins and destructive enzymes are proteins, so Clindamycin offers the theoretical advantage of shutting down the poison factory as well. But I.D. was so worried she called the surgeons. The surgeons ordered a CT scan.

If it showed tissue destruction, I would never forgive myself. Any mottled or ratty-looking patches would be a sign that strep toxins were tearing up the normally smooth and dense muscle tissue.

But the CT scan was negative. The next day Kevin and I trooped up together. The leg still looked bad, but no worse. Mrs. Anders lay watching TV, ignoring us, as if to deny any association with that damn leg.

The following morning, Kevin came downstairs looking worried.

"It’s bad," he intoned. "The leg has huge blisters filled with pus. It’s like all her skin is falling off."

But I had been upstairs before him.

"No," I reassured him, "it’s not pus, just yellow inflammatory fluid, as in a blister after a burn. She’s getting better. But if you hadn’t figured out what was happening, she’d be dead now."

Kevin didn’t smile, despite the compliment. He still seemed stunned at how unforgiving a routine infection could be.

A week later I encountered the I.D. consultant.

"You know," she told me, "the medicine team still says the PTT was a lab error. They think she was doing fine on the Cefazolin. They said it was only strep."

Strep has a long and daunting history of capitalizing on human inattentiveness. Where lies the pigheadedness gene, I wondered, that deludes each generation into dismissing the lessons nature has taught its forebears—and at such cost?

The consultant shrugged. Kids these days. No respect.