

**ANTONINO** So as I've emphasized, I'm a clinician. I see patients in clinic. And the question is, what do NTM patients look like?

**CATANZARO:** Well, they vary quite a bit. So in our multidisciplinary TB clinic, the most common patient-- the most common symptom that pulmonologists see across the board is cough. And that, in fact, is the most common symptom of patients with NTM disease. Not to say that all patients with cough have NTM disease, but all patients with NTM disease-- almost all have cough as a major problem, as a major symptom.

Unfortunately, since cough is so common, it's commonly overlooked because everybody has cough. And everybody has cough more when they have a cold, and patients with NTM similarly react that way as well. They'll be OK for a while, then they'll cough for a while. They'll have a productive cough for a while, and then it gets better. It waxes and wanes. And it may go on for multiple years before they would think that it's an issue that they want to see the doctor for.

So cough is by far the most common symptom. Sputum production is the next most common. And in fact, it's what really brings patients in. So patients will often ignore the cough, but when it's productive, that's when they start getting concerned, because most patients don't like to spit, and they don't like to swallow the cough-- swallow the sputum. And so it becomes an issue that is something to go see the doctor about.

Another very common symptom is hemoptysis. So patients, depending on how attuned they are to their body, might ignore the cough, might ignore the sputum, but when they cough up blood, that gets their attention, and they'll come in with that. So those are by far the most common symptoms. But as I said, they're common across the board, and the question is, are they due to NTM or are they due to a wide variety of other diseases?

Another common symptom is fatigue. Again, a lot of people are fatigued, particularly patients in the group that NTM tends to be a problem with, which is the elderly. So again, it can be ignored until it becomes quite severe. The next most common symptom is fever, a chronic, low-grade fever, late afternoon, getting patients to take to their bed and take a nap. And again, NTM disease is common in the elderly, and these are common symptoms. They're common non-specific symptoms. But they start to add up-- cough, sputum production, hemoptysis, fatigue, fever.

So as the disease progresses, these symptoms become more and more problematic, and they become more and more likely to bring the patient to see the doctor. And again, these symptoms are often confused with tuberculosis because tuberculosis, or for that matter other chronic infections, such as coccidioidomycosis or histoplasmosis, blastomycosis-- all of these chronic pulmonary infections all have the same series of symptoms.

I think if anything stands out about NTMs, it's the chronicity, the slowness of all this. So most patients with TB don't have symptoms for five years. Other patients with NTM often do. Not everybody, but that's very common. And of course, the comorbidities are things that we look for as clinicians. GERD. But again, GERD is very common. Gastroesophageal Reflux Disease causes reflux and causes irritation of the throat, causes cough and sputum production. It also causes NTM. It's a risk factor for getting NTM, as are chest deformities.

We often think of pigeon chest as being a malformation of the chest wall that predisposes people to have NTM disease. And again, that's very common. They've had it all their life. So why now, all of a sudden, does it become an issue? So there are a variety of comorbid situations that we look for as we start to work up patients with NTM, in part because they might explain the cough and sputum production, and in part because they increase the likelihood of finding NTM disease.