Study links sinusitis to microbial diversity, suggests new approach for dealing with common ailment

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A common bacteria ever-present on the human skin and previously considered harmless, may, in fact, be the culprit behind chronic sinusitis, a painful, recurring swelling of the sinuses that strikes more than one in ten Americans each year, according to a study by scientists at the University of California, San Francisco.

The team reports this week in the journal *Science Translational Medicine* that sinusitis may be linked to the loss of normal microbial diversity within the sinuses following an infection and the subsequent colonization of the sinuses by the culprit bacterium, which is called *Corynebacterium tuberculostearicum*.

In their study, the researchers compared the microbial communities in samples from the sinuses of 10 patients with sinusitis and from 10 healthy people, and showed that the sinusitis patients lacked a slew of bacteria that were present in the healthy individuals. The patients also had large increases in the amount of *Corynebacterium tuberculostearicum* in their sinuses, which are located in the forehead, cheeks and eyes.

The team also identified a common bacterium found within the sinuses of healthy people called *Lactobacillus sakei* that seems to help the body naturally ward off sinusitis. In laboratory experiments, inoculating mice with this one bacterium defended them against the condition.

"Presumably these are sinus-protective species," said Susan Lynch, PhD, an associate professor of medicine and director of the Colitis and Crohn's Disease Microbiome Research Core at UCSF.

What it all suggests, she added, is that the sinuses are home to a diverse "microbiome" that includes protective bacteria. These "microbial shields" are lost during chronic sinusitis, she said, and restoring the natural microbial ecology may be a way of mitigating this common condition.

A Painful, Costly Condition

Sinuses are air-filled cavities in the front of the skull that connect to the nasal passages and are lined with mucosal surfaces. They are somewhat shrouded in mystery. Scientists are not entirely sure what they do. They may exist to heat air as it passes into the body, they may be associated with the immune system, or as Lynch and her colleagues speculate, they may represent a site of microbial surveillance just inside the nose where the body can sample bacteria and other microbes entering the body.

Though the sinuses' underlying purpose is still unclear, they are all too familiar to American doctors and their patients because of what happens when the thin tissues lining them become inflamed, as occurs in chronic sinusitis—one of the most common reasons why people go to the doctor in the United States. There are about 30 million cases each year, and the cost to the healthcare system is an estimated $2.4 billion dollars annually.

The pain of sinusitis can last for months. Doctors typically prescribe bacteria-killing antibiotics and, in more severe and long-lasting cases, conduct sinus surgeries. However, said Andrew Goldberg, MSCE, MD, the director of rhinology and sinus surgery at UCSF and a co-author on the paper, "the premise for our understanding of chronic sinusitis and

therapeutic treatment appears to be wrong, and a different therapeutic strategy seems appropriate."

The new work suggests that if the underlying cause of sinusitis is due to changes to the microbiome of bacterial species colonizing sinus tissue, restoring the naturally-occurring, protective bacteria to these cavities may be an effective way to treat this condition.

However, the UCSF-led team warned that the promise of this discovery does not offer an immediate new treatment or cure for sinusitis. Any new approaches based on these observations still have to be developed and tested for safety and effectiveness in human clinical trials.

More information: The article, "Sinus Microbiome Diversity Depletion and Corynebacterium tuberculostearicum Enrichment Mediates Rhinosinusitis" by Nicole A. Abreu, Nabeetha A. Nagalingam, Yuanlin Song, Frederick C. Roediger, Steven D. Pletcher, Andrew N. Goldberg, and Susan V. Lynch appears in the September 12, 2012, issue of *Science Translational Medicine*.

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