Multi-Omics Analysis Defines Endotypes and Systemic Inflammation in Primary Ciliary Dyskinesia: A Comparison with Healthy Controls

Research Summary

Click Here for the Original Article!

Key Take-Home Message for Patients & Families

Many people with PCD have ongoing inflammation throughout the body even when they feel relatively well and are not experiencing an infection. Saliva may provide a simple, non-invasive way to monitor this inflammation, and the discovery of different inflammatory endotypes moves us closer to personalized medicine, where treatments can be matched to each patient's unique inflammatory profile. This study also demonstrates the value of international collaboration in advancing PCD research and improving care for patients worldwide.

What did this study look at?

This study examined whether people with Primary Ciliary Dyskinesia (PCD) have ongoing inflammation throughout their body, even when they are not experiencing a lung infection or exacerbation. Researchers also evaluated whether saliva could provide the same information as a blood sample to measure inflammation.

The study used advanced "multi-omics" technologies to analyze genes, proteins, and the oral microbiome in participants with PCD and healthy individuals from the United States, Puerto Rico, and Mexico.

What was the research question?

Researchers wanted to answer several important questions:

1. Do people with PCD have ongoing inflammation even when they are clinically stable?
2. Is the inflammation limited to the lungs, or does it affect the whole body?
3. Can saliva be used instead of blood to measure inflammation?
4. Do all people with PCD have the same type of inflammation, or are there different inflammatory patterns (endotypes)?

5. Could identifying these inflammatory patterns help guide personalized treatments in the future?

Who took part in this study?

A total of 76 participants were enrolled – 51 people with PCD, and 25 healthy controls. Participants were recruited from multiple centers in Texas (USA), Puerto Rico, and Mexico. All samples were collected when participants were not experiencing an acute respiratory infection or exacerbation.

What were the results?

The study found several important discoveries:

People with PCD had ongoing inflammation even when they were not sick

Many participants with PCD showed elevated inflammatory genes and proteins despite being clinically stable and free of acute infection. This suggests that inflammation is an ongoing part of the disease and not only present during exacerbations.

The inflammation was systemic (throughout the body)

Inflammatory signals were found not only in the airways but also in blood and saliva, indicating that PCD can involve the entire body. This may help explain symptoms that some patients experience outside the lungs, such as:

- Fatigue
- Fever-like feelings
- Low energy
- General malaise
- Abdominal discomfort and other systemic symptoms

Saliva closely matched blood results

One of the most important findings was that saliva and blood showed very similar inflammatory patterns. This suggests that saliva may provide a simple, non-invasive way to monitor inflammation without requiring blood draws.

Not all patients had the same type of inflammation

Researchers identified five different inflammatory endotypes (subtypes) in PCD.

Most patients showed inflammation driven by neutrophils and related immune pathways, but others had inflammatory patterns involving different immune responses, including Th2 and Th17 pathways.

This demonstrates that PCD is not the same in every patient from an inflammatory perspective.

International collaboration strengthened the research

By combining participants from multiple centers in the United States, Puerto Rico, and Mexico, researchers were able to study a larger and more diverse group of people with PCD. This highlights the importance of international collaboration in advancing research for rare diseases.

What are the conclusions?

This study shows that many people with PCD have ongoing systemic inflammation even when they are not experiencing an exacerbation. The findings suggest that:

- Chronic inflammation may contribute to symptoms and disease progression.
- Saliva can serve as a promising non-invasive alternative to blood for measuring inflammation.
- Patients with PCD do not all have the same inflammatory profile.
- Identifying inflammatory endotypes may help develop more personalized approaches to treatment and monitoring.
- Collaborative international research can accelerate discoveries and improve understanding of rare diseases such as PCD.

What are the considerations?

While these findings are encouraging, several considerations are important:

- This was a cross-sectional study, meaning participants were studied at a single point in time. Additional studies are needed to understand how inflammation changes over time.
- The study identified different inflammatory endotypes, but more research is needed to determine which treatments work best for each subtype.
- Saliva shows great promise as a monitoring tool, but further studies are needed before it becomes part of routine clinical care.
- The study does not prove that inflammation causes every symptom experienced by people with PCD, but it suggests that systemic inflammation may contribute to symptoms beyond the lungs.
- Future studies will help determine whether anti-inflammatory therapies can be targeted to specific endotypes and improve outcomes.

Citation

Ricardo A Mosquera, Ivan Gustavo Magana-Ceballos, Wilfredo De Jesus Rojas, Xiangsheng Huang, Haniyeh Koochak, Maria E Tellez, Jose Ariel Castillo-Moguel, Faraz Bishehsari,

Mahboobeh Mahdavinia, Marcos J Ramos-Benitez, Tomika Harris, Aravind Yadav, Kereisha Owens, Ricardo Lemus-Rangel, Mar Romero, Suhei Zuleta, Ara Luz, Anel Baltazar-Fernandez, Katrina E McBeth, Syed Hashmi, Gabriel Rosario Ortiz, Joel Santoyo-Rios, Jose Francisco Loyo-Rodriguez, Giuseppe N Colasurdo, Multi-Omics Analysis Defines Endotypes and Systemic Inflammation in Primary Ciliary Dyskinesia: A Comparison with Healthy Controls, *Annals of the American Thoracic Society*, 2026;, aaoag152, https://doi.org/10.1093/annalsats/aaoag152