HIV and Inflammation

WHAT IS INFLAMMATION?

Inflammation is an early response to infection or injury. It is a non-specific immune response and does not vary depending on the type of injury or infection.

Most of the body's healing tools circulate in the blood. These include antibodies, T-cells and other white blood cells, clotting factors, chemicals that kill germs, and nutrients to feed damaged cells.

Injured cells release chemicals that communicate with the immune system. They attract healing cells and chemicals. Inflammation helps these healing factors leave the bloodstream and work on damaged tissue. Blood vessels enlarge, increasing blood flow to the damaged area. Inflammation changes the structure of blood vessels, making it easier for plasma to pass into the surrounding tissues. This causes swelling. Inflammation also causes redness, heat, and pain. In addition, it reduces tissue function.

Coagulation (the formation of blood clots) is part of inflammation. This can occur in the skin (for example, stopping bleeding from a cut) or inside the body (for example, building a barrier around germs or protecting a damaged area in the lining of a blood vessel.)

Coagulation has to stay in balance with the breakdown and removal of clots. This process is called *fibrinolysis*. Fibrin is the protein that forms clots. *Lysis* means reduction or destruction.

ACUTE AND CHRONIC INFLAMMATION

Acute inflammation normally occurs in response to physical injury such as a cut, sprain, or localized infection. Acute inflammation ends when specific chemicals circulate to turn off the inflammation.

However, inflammation can also be chronic. Chronic inflammation causes tissue damage and scarring. The blood vessels stay permeable. White blood cells continue to leave the blood and accumulate in the tissue. Immune cells can wear out and stop working correctly. Chronic inflammation eventually destroys surrounding tissue and creates scar tissue. It can also contribute to allergies, asthma, or autoimmune conditions like arthritis and multiple sclerosis. In autoimmune diseases, the body sometimes makes antibodies that attack healthy cells.

Ongoing inflammation is associated with many chronic diseases. These include heart failure, kidney problems, metabolic syndrome, diabetes, dementia, and frailty. Read more about HIV and related diseases.

HIV CAUSES INFLAMMATION

HIV is a chronic infection. Even people with an undetectable viral load make new virus. This may contribute to continuing inflammation. A lower viral load is linked to lower levels of inflammation. Antiretroviral medications (ARVs) reduce inflammation but not to normal levels.

Over time, HIV weakens the immune system. Old infections may come back. Almost everyone with HIV is also infected with cytomegalovirus (CMV). Latent CMV infection can become active in people with HIV, causing additional Inflammation.

Other infections or illnesses (co-morbidities) are important in understanding the health of people with HIV. Hepatitis and herpes simplex virus (HSV) infections are also common.

LEAKY GUT SYNDROME

The mouth and digestive tract, like the skin, protect the body from external threats. At the top end of the digestive tract is the mouth. Poor dental health can lead to general infection and inflammation.

The gut normally contains about 70% of the body's immune cells. The intestines have a surface area approximately equal to the size of a football field! The immune system in the gut is called gut-associated lymphoid tissue (GALT). It protects the body from germs in food. HIV damages GALT very early in infection.

Inflammation in the gut makes it easier for germs to pass out of the intestine and leak into the body's circulation. This leaky gut contributes to overall (systemic) inflammation. Inflammation in the gut also contributes to poor absorption of nutrients.

Lipopolysaccharides (LPS) are molecules that are part of the coating of some bacteria normally found in the intestines. LPS produces a strong immune response. High levels in the blood are a sign of leaky gut syndrome.

MEASURING INFLAMMATION

Inflammation in people with HIV shows up in high levels of some elements in the blood:

- Interleukin-6 is involved both in increasing and decreasing inflammation. It increases rapidly after exercise.
- C-reactive protein (CRP) is thought to bind to damaged cells, attracting substances that will remove them. It is a measure of general inflammation. It rises quickly and dramatically during infections.
- D-dimer is produced when blood clots break down. It is a measure of general inflammation. It is also used to diagnose blood clots, especially clots in deep veins or in the lungs.
- Cystatin C is mainly used as an indicator of kidney health. However, high cystatin C levels have been linked to heart disease, nerve problems, and higher death rates.

TREATING HIV INFLAMMATION

Researchers are looking into anti-inflammatory drugs that have been used in other diseases such as rheumatoid arthritis, and trying to learn from other studies of immune activation, inflammation, and aging.

Another area of research in HIV involves the bacterial environment of the gut. These bacteria can affect the outcomes of many diseases. Interventions that affect these bacteria may be helpful. This includes probiotics such as acidophilus and other live cultures that stimulate the growth of helpful bacteria in the gut.

THE BOTTOM LINE

Inflammation is a complex process. Acute inflammation is a normal part of the body's healing process. Chronic inflammation can damage the body and is associated with many chronic health problems and with normal aging.

HIV is an inflammatory disease and causes chronic inflammation. This can accelerate physical changes normally associated with aging.

Various possible treatments for chronic inflammation are being studied.

MORE INFORMATION

San Francisco AIDS Foundation: The Low-Down on Inflammation from an HIV Doctor

POZ: What Is Chronic Inflammation and Why Is It Such a Big Deal for People With HIV?

nam aidsmap: Could a better understanding of inflammation help research towards an HIV cure?

Reviewed July 2025