

THE INFLAMMATORY PROCESS

When people hear of inflammation, the first thought that usually comes to mind is pain, heat and tissue damage at the site of the injury. Before you can start treating inflammation, you have to know what it is, understand the process behind it, and determine whether or not it is harmful. The term inflammation literally means “burning”. The characteristics of inflammation are pain, heat, swelling, and redness. Inflammation is the response of tissues to irritation or injury.

Inflammation is one of the most important and vital protective mechanisms in the body. Inflammation allows defense factors, such as antibodies and white blood cells, to gain access to sites of bacterial invasion or tissue damage. The inflammatory process is a union of the responses that promote healing and repair.

Inflammation is categorized according to its severity and duration. Recent injury (acute) has different characteristics from a prolonged (chronic) inflammatory event. Acute inflammation starts to occur within a few hours of the initial injury or infection. The injured tissue becomes warm and reddened from an increase in blood flow caused by vasoactive substances called cytokines. Subsequently, the tissue swells as fluid leaks out of the blood vessels and into the surrounding tissues.

The neutrophil (a type of white blood cell capable of engulfing and destroying bacteria and other disease agents) adheres to blood vessel walls and actively migrates into damaged tissues. Once the neutrophil reaches the injured tissue, it ingests and destroys foreign material or cells injured by the trauma or subsequent inflammation.

As blood vessels and tissues are damaged or stimulated, molecules from damaged cell membranes are formed by enzymatic reactions. The products of these reactions stimulate further white blood cell migration, increase the permeability of vasculature, cause smooth muscle contraction, dilate blood vessels, and promote clumping of platelets. This is the part of the blood clotting system that produces fibrin, which blocks injured blood vessels and leaks into injured tissue during inflammation to create a barrier to the spread of infection.

Blood contains several factors that either inactivate inflammatory mediators or inhibit the enzymes that generate the mediators. Because acute inflammation has the potential to cause severe tissue damage, the body has the ability to control the inflammation unless it becomes overwhelming. It is for this reason that veterinarians employ a variety of anti-inflammatory drugs in an attempt to limit, control, or modify the inflammatory cascade.

Chronic inflammation begins hours to days after neutrophils have arrived at an inflammatory focus. It involves macrophages (specialized white blood cells that kill and clean up damaged tissue and cells).

Macrophages are usually found in chronic areas of inflammation. Neutrophils and macrophages both migrate into the tissues, but neutrophils are “rapid-reaction cells,” while macrophages are larger and slower-reacting. Neutrophils arrive in greater numbers, but macrophages have a longer lifespan and are present in the tissue for hours to days.

Macrophages ingest cellular debris and prepare the tissue for repair. Fibroblasts synthesize the tissue protein collagen and migrate into tissue to repair defects and provide a matrix for blood vessels to grow into the injured area. Collagen is deposited throughout the damaged region and is gradually remodeled over several weeks or months to create normal tissue structure or scar tissue.

The success of the healing process depends largely on the effectiveness of the acute inflammatory response. If the acute inflammatory response is able to rapidly rid the area of the inciting stimuli or cells damaged by trauma, then healing can occur uneventfully. If the body cannot rid itself of the inflammatory stimuli by the enzymes of neutrophils and macrophages, the inflammatory process persists and neutrophils and macrophages continue to be attracted to and invade at the site of inflammation.

This continued invasion and stimulation of new inflammation creates a cyclic process that prevents healing and

maintains tissue inflammation. With excess and cyclic inflammation, a granuloma or granulation tissue will be created in an attempt to wall off infection or heal a tissue defect created by the inflammation.

When an animal suffers from a systemic inflammatory stimulus (an infection), a set of systemic responses occur resulting in a consistent set of clinical signs. These signs include fever, depression, lethargy, decreased feed intake, and muscle wasting. If a horse receives a minor cut, then the inflammation remains localized and you might not see any of these signs.

The response to inflammation can be local or systemic, and it often depends on the magnitude of the initial insult. An infection or release of a toxin such as endotoxin from injured intestine often causes a severe systemic effect.

Even if the injury is localized to one organ such as the lung or intestine, the generalized inflammatory effect can be lethal as the body over-responds to the insult. Therefore, the goal of treatment is to treat or remove the cause of inflammation, but at the same time decrease inflammation so it doesn't cause permanent damage, scarring, or even death. Early treatment is essential. Once the inflammatory cascade begins to damage healthy tissue as part of the defensive response, treatment becomes more difficult and more costly.

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