Chronic Inflammation

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If inflammation has a subdued, quiet onset and lasts for days to weeks, the term "chronic inflammation" is used. This type of inflammation is, then, characterized by an insidious onset and long duration. The signs and symptoms of chronic inflammation are not as dramatic as those associated with acute inflammation.

Etiology and Pathogenesis of Chronic Inflammation

If an inflammatory reaction starts as acute but persists, it will enter a chronic phase. There are two general causes of such persistence: the inability to eliminate or continual reacquisition of the offending agent. These situations are common in dentistry where, for example, an open pulp chamber keeps reintroducing inflammatory/bacterial products into the tissues around the root (periapical tissues). It also may occur when there is continual exposure to some inanimate materials like pollens and dusts. More often than not, chronic inflammation arises without going through an acute phase first (de novo chronic inflammation). Two examples of this come to mind: persistent infections and autoimmune diseases. Infection with a microorganism of low virulence that cannot be eliminated easily may result in chronic rather than acute inflammation. Tuberculosis and some dental conditions (to be discussed later) are examples of such infections. Sometimes a patient may be "allergic" to her/his own cells. This condition is known as autoimmunity. In these cases, the affected patient's cells serve as a source of constant stimulation of the chronic inflammatory process. Systemic lupus erythematosus and rheumatoid arthritis are autoimmune diseases characterized by chronic inflammation.

The Cells of Chronic Inflammation

The mixture of cells associated with chronic inflammation is different than the mixture associated with acute inflammation. In chronic inflammation, macrophages and lymphocytes are the predominant cells; there are few, if any, neutrophils. These, along with most other cells associated with chronic inflammation, have single nuclei. Because of this feature, they

are commonly known as “mononuclear cells.

Macrophages

Macrophages are monocytes that entered an area of tissue injury. They can live for months and can thrive in acid environments. In order for macrophages to carry out their functions, they must be stimulated (activated) by chemical mediators. Among the chemical mediators are lymphokines (cytokines secreted by lymphocytes), fibronectin-coated surfaces, and mediators that initiate acute inflammation.

Macrophages are excellent phagocytes. They engulf and process antigens allowing them to be neutralized by other cells (lymphocytes). Activated macrophages can also engulf and kill certain microorganisms. Macrophages also secrete a number of substances that assist in the recruitment of other cells (monokines) and cause tissue destruction (collagenases, elastases, reactive oxygen).

T-Lymphocytes

Lymphocytes emigrate from blood vessels late in an inflammatory reaction. Lymphocytes account for about one-third (33%) of the circulating leukocytes; they are the predominant cells in chronic inflammation. There are two types of lymphocytes: T and B. T lymphocytes arise from the thymus gland and are responsible for cell-based immunity. B lymphocytes, on the other hand, arise from bone marrow and are responsible for humoral immunity. T cells must be activated before they carry out their functions. Such activation is effected by monokines (secretory stimulants from monocytes [macrophages] and, in some cases, directly by antigens. Once activated, lymphocytes can react with certain antigens destroying them or rendering them harmless. They also secrete lymphokines that stimulate macrophages. Thus, macrophages and lymphocytes are interdependent—the activation of one stimulates the activation of the other.

B-Lymphocytes (Plasma Cells)

Plasma cells are derived from activation of a class of lymphocytes known as “B cells.” They do not circulate in the blood stream but are transformed in lymphoid organs or at the site of chronic inflammation. They are recognized by their off-center nuclei, abundant basophilic cytoplasms, pale spots near the nuclei (negative Golgi images), and clock-face distribution of nuclear chromatin. Plasma cells manufacture and secrete antibodies against specific antigens. The antibodies that circulate in blood plasma are derived from plasma cells; these circulating

antibodies are called “humoral antibodies.” A plasma cell can only produce antibodies against a single antigen. Once a B lymphocyte is activated, it
proliferates creating a clone of cells capable of producing antibodies against the antigen that stimulated it.

Eosinophils

Eosinophils are related to neutrophils; both display a segmented nucleus; both are polymorphonuclear leukocytes. Eosinophils comprise about 3% of the circulating wbcs and are recognized by the bright red granules within their cytoplasm. These granules are filled with a substance called "major basic protein" that can destroy some parasites and some cells. These cells are not seen in all chronic inflammatory reactions. Rather, they appear in parasitic infestations, hypersensitivity reactions, and some autoimmune conditions.

Multinucleated Giant Cells

Huge cells with many nuclei may appear in chronic inflammatory reactions. These cells are formed from the fusion of several macrophages and are called "multinucleated giant cells." They are often seen associated with foreign particulate matter (splinters, talc, debris). They may also accompany reactions to certain microorganisms of low virulence (e.g. tuberculosis).

Fibroblasts and Collagen

Fibroblasts and the collagen they produce are prominent features of chronic inflammation. In fact, overexuberant collagen formation may permanently deform inflamed tissues; this circumstance in known as "fibrosis." Fibroblasts are recruited to enter an area of tissue injury by lymphokines and monokines. Once in the area, they produce collagen to replace that which has been destroyed. In the inflammatory reaction does not resolve in a reasonable time, the collagen can build up to scar tissue proportions (fibrosis).

The Microscopic Features of Chronic Inflammation

The presence of lymphocytes (and often, macrophages) and collagen are the two constant microscopic features of chronic inflammation. While plasma cells, eosinophils, and giant cells may appear in certain situations, lymphocytes are always present and if the reaction lasts more than a week or two collagen is always present as well. Dilated blood vessels so characteristic of acute inflammation are usually absent in chronic inflammation.

The Clinical Features of Chronic Inflammation

The redness, warmth, swelling, pain, loss of function, and fever associated with acute inflammation are absent or greatly suppressed in chronic inflammation