

What is an Eosinophil?

INTRODUCTION

An early pathologist must have thought that eosinophils brightened the day! Stedman Medical Dictionary identifies the prefix *eos-* as derived from the Greek work for dawn, and the suffix *-philos* from the Greek work for fond. The granules in the cytoplasm of eosinophils stain red with both Wright-Giemsa stain, used to stain blood smears, and hematoxylin-eosin stain, used to stain slides of tissue. An early histologist, undoubtedly trained in classical languages, may have seen red skies at the beginning of days spent at the microscope and slide stainer, and thought eosinophil was a good name for a cell with cytoplasmic granules that consistently stain bright red! The name distinguishes eosinophils from other white blood cells having granules, such as neutrophils that have granules that stain the same as the cytoplasm, and basophils that have cytoplasmic granules that stain blue.

LIFE CYCLE

Eosinophils are produced in the bone marrow, along with other white blood cells and red blood cells. Eosinophils circulate at relatively low levels in the bloodstream. Normally, there are none, or up to 450 eosinophils in the circulating blood of adults, comprising only 1-3% of circulating white blood cells.

However, unlike some other circulating cells, eosinophils are also normally found outside blood vessels in organs other than bone marrow. In fact, the organ of the body that normally has the most eosinophils is the gastrointestinal tract. After they leave the bone marrow, eosinophils circulate only a short time, and about half migrate out of blood vessels and into tissue during their first circulation.

Many influences determine eosinophil proliferation, migration, activation, and disposal. Balance among these influences maintains the normal steady-state of production, distribution, and death/disposal. Cytokines are proteins secreted by many different cells that modulate virtually all aspects of inflammation. The major stimulus for eosinophils to form in the bone marrow is the cytokine interleukin-5 (IL-5). Chemokines are types of cytokines that direct cell migration. The major stimulus for eosinophils to leave the blood stream and enter tissue seems to be the chemokine eotaxin.

FRIEND OR FOE?

Eosinophils normally function to protect the body. These cells participate in engulfing and killing bacteria and other microorganisms such as parasites.

What causes an abnormal number of eosinophils to accumulate in the bowel? Eosinophils in excess numbers may be seen in bowel that is infected with parasites or other microbes, and in those circumstances eosinophils function to eliminate undesirable microorganisms. Parasites are too large to be engulfed, so eosinophils attach to their surface and extrude their red granules that contain powerful substances that kill the invading organism.

Eosinophils also accumulate in excess numbers as part of a reaction to antigenic stimulation. Allergy, cow's milk intolerance, and gluten sensitivity characteristically cause increased numbers of eosinophils in the bowel mucosa.

There are, however, a number of disorders of unclear etiology in which there are too many eosinophils in the bowel. Eosinophilic gastroenteritis that does not have an identifiable cause, such as parasitic infection, is one of those diseases, and

hypereosinophilic syndrome affecting the bowel is another. Some inflammatory polyps contain excess eosinophils, and inflammatory bowel disease, particularly ulcerative colitis, often exhibits tissue eosinophilia at some time during the course of the disease.

SO WHAT?

What difference does it make if tissue contains more than a normal number of eosinophils? Well, for one thing, tissue eosinophilia correlates with symptoms in some patients. When there are too many eosinophils, the patient has dysphagia, or diarrhea. In biopsies from such patients, not only are there too many eosinophils, but some have extruded their granules into the tissue, a process known as degranulation. If treatment reduces the number of eosinophils in those patients, the symptoms decrease or disappear. This implies that the substances contained in the eosinophil granules may contribute to the patient's symptoms. Another possible association with increased tissue eosinophils is tissue damage. In the esophagus, the epithelium becomes quite thick, and there is increased epithelial cell turnover. In the colon, the epithelium lining the crypts may become damaged, and the normal function of resorbing water may become impaired, resulting in diarrhea. The long-term consequences of increased tissue eosinophils are not known.

TREATMENT

For patients who have an identified cause for increased numbers of eosinophils in the GI tract, treatment is aimed at eliminating the cause. For example, antibiotics can help eradicate a parasitic infection. For patients who have a limited number of allergies or intolerances or sensitivities, elimination of the offending substances from the diet may be all that is required. For patients who have many allergies, and for patients who do not have an identifiable cause, treatment may consist of anti-inflammatory drugs, steroidal or nonsteroidal. Steroids have consequences in children that may not be problematic in adults. For example, high doses of steroids interfere with bone growth. Some patients, including adults, have disease that is or becomes resistant to treatment with steroids. Therefore, other methods of treatment aimed at interrupting the cycle of eosinophil recruitment and migration into tissue are currently being explored.

Author: Margaret Collins MD, revised 12-16-04

Photo 1: Eosinophil in the blood

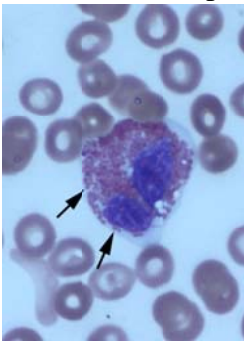
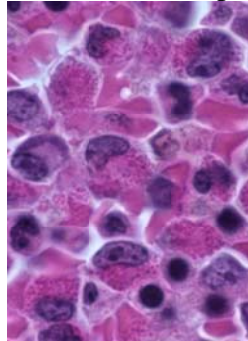


Photo 2: Eosinophils in the bone marrow



Images courtesy of Dr. Margaret Collins, Cincinnati Children's Hospital and Medical Center