Best Practice & Research Clinical Gastroenterology
Vol. 22, No. 3, pp. 511–536, 2008
doi:10.1016/j.bpg.2007.12.004
available online at http://www.sciencedirect.com

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Eosinophilia during intestinal infection

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Eosinophilia is a common finding in tropical developing countries, and is mainly caused by chronic helminth infections, predominantly of the gut. Although only a minority of infections is symptomatic, development during childhood can be impaired, and in some patients serious complications and sequelae may occur. Eosinophilia in helminth infection is typically associated with a strong Th2 immune response, and eosinophils can effectively kill or damage larvae and adult worms in vitro. However, in vivo, eosinophils are only partly effective in the control of helminth infection, and recent research has shown that eosinophils are involved in a range of immunomodulatory effects, such as increased production of the down-modulatory cytokines interleukin 10 and tumour growth factor β, as well as stimulation of regulatory T cells and alternatively activated macrophages. Increasing evidence suggests that immunomodulation favours parasite survival and reduces immune pathology. On the other hand, immunomodulation induced by helminth infections may contribute to protection from allergic and autoimmune responses, as proposed by the 'hygiene hypothesis' to explain the increase in allergic diseases in the industrialised world. The predictive value of eosinophilia for the presence of helminth infections is limited and depends on the epidemiological background and the extent of the eosinophilia. It increases considerably in populations with a high prevalence of parasitic infections, as in developing tropical countries or in travellers to those areas.

Key words: eosinophil; intestinal infection; helminth; immunomodulation.

Blood and tissue eosinophila is common in infections by helminth parasites.[1] In contrast, most viral, bacterial and fungal infections are not associated with eosinophilia, but typically cause eosinopenia and may suppress eosinophilia from other causes. However, there are some exceptions to this rule, and significant eosinophilia can be observed in patients with HIV infection and a few other infections.[2]

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1521-6918/$ - see front matter

From a clinical point of view, eosinophilia is a rather unspecific sign, and in addition to helminth infections it may be seen in a large variety of non-infectious diseases (Table 1), such as allergies including asthma, drug hypersensitivity reactions, neoplasm, connective-tissue disorders, primary hypereosinophilic syndromes, and transplant rejection.[3,4] However, in areas with a high prevalence of parasitic infections, such as rural areas in developing countries, or in travellers returning from such areas, blood eosinophilia may be the first or only indication of a condition with potentially serious sequelae, such as schistosomiasis or strongyloidiasis, and is often useful in guiding the diagnostic evaluation in symptomatic patients.[5,6] Extensive eosinophilia can be an important diagnostic feature in several tissue-invasive helminth infections. However, the incidence and extent of infection-related eosinophilia do not depend only on the type, intensity and stage of infection; other factors such as individual differences in innate and adaptive immune responses, epidemiological background, age at first exposure, underlying conditions, etc are important as well.

Eosinophils exert a range of biological effects not only against helminth parasites and the surrounding host tissue but also (in some allergic and autoimmune diseases) leading to inflammation and damage of affected tissues. Eosinophilia in helminth

Table 1. Diseases and disorders associated with eosinophilia.

Infectious diseases	Helminth infections (see Table 2)
	Viral: HIV infection, HTLV 1/2 infection
	Baterial: resolving scarlet fever, chronic tuberculosis
	Fungal: coccidioidomycosis, bronchopulmonary aspergillosis
	Protozoal: isosporiasis, dientamoebiasis, sarcocystosis
	Ectoparasitic: scabies, myiasis
Allergic disorders	Asthma
	Atopic disorders (e.g. dermatitis, rhinitis)
	Drug hypersensitivity
Neoplasm	Lymphoma, especially Hodgkin's
	Leukaemia; myelogenous, eosinophilic
	Carcinoma of the bowel, lung, ovary or other organs
Connective tissue disorders	Churg-Strauss vasculitis
	Systemic lupus erythematosus
	Rheumatoid arthritis
Hypereosinophilic syndromes	Myeloproliferative variants (F/P positive/negative)
	Lymphocytic variants (clonal, polyclonal)
	Eosinophil-associated gastrointestinal disease (EGID)
	Chronic eosinophilic pneumonia
	Eosinophilia myalgia syndrome
	Familial hypereosinophilia
	Cyclical angio-oedema and eosinophilia
	Kimura's disease
Other	Hypoadrenalism
	Cholesterol embolisation
	Sarcoidosis
	Pemphigus vulgaris, bullous pemphigoid
	Systemic mastocytosis
	Inflammatory bowel disease
	Transplant rejection

HIV, human immunodeficiency virus; HTLV, human T-cell leukaemia virus; F/P, FIP1L1/PDGFRA mutation.