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The Thistle QA CEU No is: MT- 2014/004

Each attendee should claim THREE CEU points for completing this Quality Control Journal Club exercise, and retain a copy of the relevant Thistle QA Participation Certificate as proof of registration on a Thistle QA EQA.

DIFFERENTIAL SLIDES LEGEND

CYCLE 43 SLIDE 6 - JANUARY 2014

LYMPHOCYTES

In healthy people there are at least five types of white cell or leucocyte in the circulating blood. Unlike red cells, white cells have retained their nuclei. The cell is therefore made up of a nucleus and cytoplasm. The cytoplasm is the site of protein synthesis and other cellular functions. The nucleus is composed of chromatin, which is mainly DNA, carrying genetic messages. Genetic messages are transmitted from the nucleus to the cytoplasm by RNA.

White cells are divided into granulocytes (also known as polymorphonuclear leucocytes) and mononuclear cells. There are three types of granulocytes and two types of mononuclear cells. Granulocytes are so named because their cytoplasm contains prominent granules. However, monocytes also have granules and so do some lymphocytes. The term polymorphonuclear leucocyte refers to the very variable nuclear shape which is typical of granulocytes. The term mononuclear cell means that the cell has only a single nucleus. However, this is true of granulocytes, as well as of the cells conventionally referred to as mononuclear.

The functions of the WBC

Cell	Major function
Neutrophil	Is attracted to sites of infection by a process known as chemotaxis; ingests micro-organisms (a process known as phagocytosis) and destroys them
Eosinophil	The same functions as the neutrophil, in addition, helps control parasitic infections; has a role in allergic responses
Basophil	Has a role in immediate hypersensitivity reactions, allergic and inflammatory responses and in the control of parasitic infections
Lymphocyte	<p>Mediates immune responses</p> <p>B lymphocyte matures into a plasma cell, which secretes antibodies (humoral immunity)</p> <p>T lymphocyte attacks cells bearing foreign antigens and antibody-coated cells; can help or suppress B cells (part of cell-mediated immunity)</p> <p>Natural killer lymphocyte (NK cell) attacks foreign cells and tumour cells (part of cell-mediated immunity)</p>
Monocyte	Phagocytoses and kills micro-organisms including mycobacteria and fungi, phagocytoses cells or organisms that have bound immunoglobulin or complement and phagocytoses dead and damaged cells; presents antigen to cells of the immune system; migrates to tissues where it differentiates, to become a long-lived phagocytic and antigen-presenting cell known as a macrophage

Lymphocytes

Lymphocytes are the second most numerous circulating white cells after neutrophils. They are smaller than granulocytes with a round or somewhat irregular outline and pale blue, clear cytoplasm. Some lymphocytes have a variable number of azurophilic (pinkish-purple) granules. Lymphocytes are divided into three morphological categories, depending on their size, the amount of cytoplasm and the presence or absence of cytoplasmic granules. These categories are small lymphocyte, large lymphocyte and large granular lymphocyte. Small lymphocytes are most numerous. The nuclear chromatin of lymphocytes may be dense and homogeneous (particularly in small lymphocytes) or more lightly staining and somewhat heterogeneous (particularly in large lymphocytes). Occasional normal lymphocytes show a discrete but ill-defined paler structure within the nucleus, which is the nucleolus.

Lymphocytes are produced from lymphoid stem cells in the bone marrow and probably the thymus. Their function is in tissues such as lymph nodes, spleen, tonsils and the lymphoid tissue associated with mucous membranes. They circulate in the blood stream, enter lymphoid tissues and emerge again from lymphoid tissues into lymphatic channels, where they form one constituent of a clear fluid known as lymph. Lymphatics drain into the thoracic duct and ultimately into the blood stream. This process of continuing movement between tissues and the blood stream is known as lymphocyte recirculation.

Lymphocytes function in the body's immune responses. They are divided into three functional types: B cells, T cells and natural killer (NK) cells. B cells differentiate in tissues into plasma cells, which secrete antibodies, thereby providing humoral immunity. T cells function in cell-mediated immunity as do NK cells. T cells also modulate B cell function. The functional categories of lymphocyte show little correlation with morphological categories except that large granular lymphocytes are either T cells or NK cells. However, other T cells cannot be distinguished morphologically from B cells. The functional categories of lymphocytes are of far more importance than the morphological categories.

Assessing lymphocyte morphology

In assessing what is 'normal' it is necessary to consider the gender, age and ethnic origin of the person being investigated. Congenital abnormalities of lymphocytes are rare. Most abnormalities of lymphocyte morphology are caused by viral infections. Less often, increased numbers of lymphocytes showing a variable degree of morphological abnormality are indicative of a neoplastic process, either a lymphoid leukaemia or a lymphoma. The most striking reactive changes in lymphocyte morphology are seen in infectious mononucleosis, an illness caused by an acute infection by the Epstein-Barr (EB) virus. There is lymphocytosis and lymphocytes are morphologically very abnormal. Some are very large, some have primitive nuclei with a diffuse chromatin pattern and nucleoli, some nuclei are lobulated, and some cells have voluminous basophilic cytoplasm. The cells are pleomorphic, i.e. they vary greatly in size and shape. The lymphocytes are so abnormal that initially their true nature was not known and they were referred to as atypical mononuclear cells. Now they are more often referred to as atypical lymphocytes. Large numbers of atypical lymphocytes, similar to those seen in infectious mononucleosis, can also occur in infection

by cytomegalovirus, hepatitis A virus and adenovirus and during the parasitic infection, toxoplasmosis. Smaller numbers of atypical lymphocytes are seen in many other viral, bacterial, rickettsial and protozoan infections. Other reactive changes, in addition to those typical of infectious mononucleosis, occur in lymphocytes both during infection and during exposure to other antigenic stimuli. B lymphocytes may differentiate into plasma cells with an increased amount of basophilic cytoplasm, a pale-staining area near the nucleus (the Golgi zone) and an eccentric nucleus with clumped chromatin. There may also be plasmacytoid lymphocytes with characteristics intermediate between those of lymphocytes and plasma cells. An increase of large granular lymphocytes can also occur as a reactive change, e.g. during chronic viral infection. These cells may be indistinguishable from normal large granular lymphocytes but sometimes they show features of activation such as a larger size and more voluminous basophilic cytoplasm. Characteristic morphological changes occur in lymphocytes in different types of leukaemia and lymphoma.

Lymphocytosis and morphologically abnormal lymphoid cells

Lymphocytosis can be caused by increased mobilization of lymphocytes from tissues into the blood stream or by increased production of lymphocytes, either in response to an antigenic stimulus or as a neoplastic condition. Transient lymphocytosis, due to redistribution of lymphocytes, occurs as an acute response to severe physical stress. When there is lymphocytosis as a response to an infection there are often also morphological changes in lymphocytes; these are most striking in infectious mononucleosis, in which atypical lymphocytes are numerous. More subtle reactive changes in lymphocytes are common in other infections, particular infections in children or viral infections at any age. Lymphoid cells are also morphologically abnormal in lymphoid neoplasms.

Causes of lymphocytosis

Physiological and caused by kinetic alterations

Exercise

Epinephrine (adrenaline) administration

As an early acute reaction to physical stress (e.g. following trauma, sickle cell crisis, myocardial infarction, cardiac arrest)

Reactive

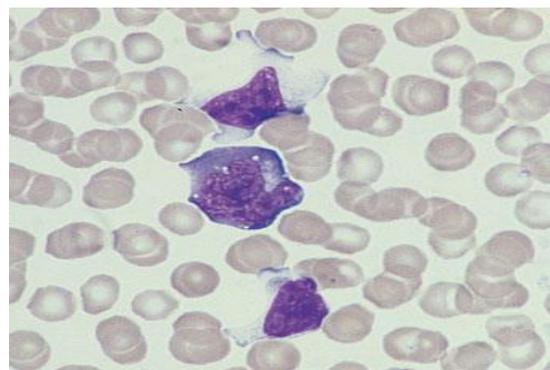
Infections [particularly viral and rickettsial infections, whooping-cough (pertussis), bacterial infections in infants and young children]

Neoplastic

Chronic lymphocytic leukaemia

Other lymphoid leukaemias

Lymphomas in leukaemic phases



Atypical lymphocytes (in infectious mononucleosis)

References

1. A Beginner's Guide to Blood Cells , 2nd Edition Barbara J. Bain

Questions

1. Discuss the functions of lymphocytes.
 2. Discuss the morphological characteristics of normal and abnormal lymphocytes.
 3. What are the possible causes of a lymphocytosis?
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