



Dendritic cells as components of adaptive immune system in mammals

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Abstract

Cells of innate immunity form a heterogeneous group of myeloid and lymphoid populations includes cells that serve as the first line of defense of the organism against pathogens - granulocytes, monocytes, macrophages. Furthermore, cells that protect against external influences or disorders of internal balance and intracellular infections - NK cells and dendritic cells (DCs). Due to their ability to respond to subtle changes in the body (e.g. during tumor transformation or the initial stage of infection). DCs and NK cells can translate this information but also receive it through receptor interactions and chemokines, lymphokines and neurotransmitters. Although the individual subpopulations of innate immune cells are somehow specialized, the ability to recognize and the cytotoxic executive function are common to all cells. In this review, we describe the functions of dendritic cells in mammals. DCs play an important role in infectious immunity and autoimmunity.

Keywords: dendritic cells; immunology; mammals; NK cells; T lymphocytes.

1. Introduction

The central position of innate immune cells in the immune system results from their function of recognizing antigens, transmitting information between immune cells, but also the nervous and endocrine systems, and the subsequent executive function. This is due to the presence of a wide range of not only immune receptors, but also receptors for neurotransmitters, hormones, stress proteins, glycoproteins, glycolipids and cytokine production, which further direct the development of a specific cellular or humoral response. Natural immunity cells are classified into a separate group in addition to non-specific and specific cells, with which they share some common characteristics. As with non-specific immune cells, they use lytic factors- perforins and granzymes- for their powerful cytolytic function and do not require prior recognition or processing of the antigen (Sternberg, 2006). However, antibody-mediated lysis utilizes different classes of immunoglobulins and corresponding FcR types. As

The role of dendritic cell (DC)

DC is involved in ongoing surveillance and rapid response when the organism is threatened. Immature

with cell-specific immunity (CTL), the cytotoxic executive function of NK cells is dependent on the recognition of MHC class I antigens, although the mechanism is diametrically different. In the case of a cytotoxic T lymphocyte, recognition and lysis take place in two phases. In the first phase, it is necessary to recognize the antigen by the antigen-presenting cell, processing and presentation of peptides bound to the MHC I molecule of the T cell receptor, which requires additional co-stimulatory signal as protection against apoptosis. In the second phase, the CD8 molecule is attached to the TCR complex and subsequently lysed by the target cell. In contrast, in NK cells, recognition of self-MHC I establishes a dominant inhibitory signal that neutralizes ITAM-bound PTK signaling in the cytoplasmic domain of adapter molecules associated with activating NK cell receptors, and no target cell lysis occurs. The absence of the MHC I molecule leads to the activation of the activation signal and the lysis of the target cell (Anikeeva and Sykulev, 2011).

DCs are present in peripheral organs and mucous membranes, where they continuously monitor the environment for the presence of foreign antigens.



Absorbed antigens are further processed for presentation by surface MHC molecules. Before these antigens can be presented to naïve T cells, they must go through a maturing process, in which they can be triggered directly by the pathogen, or by a specific interaction with another immune cell (Lowther and Hafler, 2012). Recognition, proliferation, migration, secretion of cytokines and chemokines, and expression of costimulatory molecules are regulated by TLR receptor-mediated signaling. Mature DC increases the expression of antigen presenting molecules (MHC I and MHC II) and costimulatory molecules (CD40, CD80 and CD86). In mammals, DCs carry CD4 and CD11b antigen and are functionally distinct (Akira and Takeda, 2006). Monocyte-derived DCs respond to TLR3, TLR4 and TLR8. The function of NK cells is strictly regulated by the balance of inhibitory and activating signals transmitted by a set of receptors of both the immunoglobulin and C-type lectin family and proinflammatory cytokines (Lanier, 2007). DCs have the ability to absorb, process and present antigens to T cells and produce cytokines that affect both the innate and adaptive immune responses. At the same time, however, they share many common properties with NK cells, which are often overlooked. Both cells functionally overlap (Spits and Lanier, 2007).

Intercellular communication

Depending on the receptor equipment, DCs after interaction with pathogens can induce NK cell activation, in which signals mediated by receptor interaction (NKG2D ligand-NKG2D, LFA1-ICAM1) or cytokine signals (IL-2, IL-12) are involved. In addition, they can induce NK cell proliferation by producing cytokines (Abbas, 2014).

Communication between cells of innate immunity and the neuroendocrine system

The central nervous system (CNS) controls the innate immunity through hormonal and nerve pathways. Neuroendocrine stress response, sympathetic and parasympathetic nerve inhibits innate immune cells at the systemic and regional level, while the peripheral neural system enhances local immune reactivity (Sternberg, 2006). These systems work together to activate and amplify the local inflammatory response in order to eliminate pathogens, end inflammation and restore homeostasis (Sternberg, 2006). Thus, the CNS is an integral part of the acute inflammatory response to antigens as well as the acquired immunity. The first line of defense at the site of inflammation is mediated by the peripheral nervous system, which releases neuropeptides that enhance the immune response (Sternberg, 2006; Abbas, 2014). In contrast, the autonomic nervous system sympathetically and parasympathetically usually progresses inflammation at the regional level by innervating immune organs.

2. Discussion

Neuroendocrine control of inflammation takes place at the systemic level and is mediated by the

hypothalamic-pituitary-adrenal axis for the pituitary-gonadal axis by releasing sex hormones by the hypothalamic-pituitary-thyroid axis and the production of thyroid hormones (Spits and Lanier, 2007). Communication between the nervous and immune systems takes place in several pathways - the central, sympathetic and peripheral nervous systems, the efferent and afferent branches of the vagus nerve or the hypothalamic-pituitary-adrenal axis (HPA) (Kenney and Ganta, 2014). Thus, the HPA axis provides important physiological feedback regulation of the inflammatory response. Impaired HPA axis function is a side effect of many autoimmune and inflammatory diseases across different animal species. From the point of view of therapeutic use, glucocorticoids form an important part of the neuro-endocrine regulation of the immune response, especially in the case of impaired regulation and excessive activation of immune cells in autoimmune diseases. Glucocorticoids suppress pro-inflammatory responses (Sternberg, 2006). Regulation, maturation, differentiation and proliferation of DC and macrophages by decreased expression of MHC II antigen and costimulatory molecules. It weakens the ability to produce inflammatory cytokines - TNF and, conversely, increases the synthesis of the anti-inflammatory cytokine - IL-10, causing a shift in adaptive immunity from the TH1 to TH2 response by inhibiting IL-12 production (Abbas, 2014). Glucocorticoids (GCs) also cause apoptosis of macrophages, DCs and T cells. GCs suppress the production of antibodies of B cells. GCs reduce the expression of adhesive molecules (ICAM 1, ELAM1) and the secretion of chemokines (CCL2, CCL7) in mammals (Akira and Takeda, 2006).

Activation of innate immunity to recognize the pathogen provides a signal not only to trigger a response, but also to activate CNS counter-regulatory responses that terminate inflammation. DCs are antigen presenting cells. They are important during communication with T lymphocytes. They have similar properties to NK cells. DCs thus form a link between non-specific and specific immunity.

Conflict of interest: This manuscript has not been published or presented elsewhere in part or in entirety, and is not under consideration by another journal. All the authors have approved the manuscript and agree with submission to your esteemed journal. There are no conflicts of interest to declare.

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