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IMMUNE SYSTEM: AN OVERVIEW

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COMMENTARY

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INTRODUCTION

Humans and different mammalians live in a world that's heavily inhabited by pathogenic and nonpathogenic microbes and contains an enormous array of harmful substances that threaten traditional physiological state. The community of microbes includes each obligate pathogens and useful commensal organisms, which the host should tolerate and hold under control to support traditional tissue and organ performance [1-4]. Infective microbes possess various assortments of mechanisms by that they replicate, spread, and threaten traditional host functions. At constant time that the system is eliminating pathologic microbes and harmful or matter proteins, it should avoid responses that turn out excessive injury of self-tissues or that may eliminate useful commensal microbes. The environment contains a large vary of infective microbes and harmful substances that challenge the host through awfully broad choice of infective mechanisms. So it's not stunning that the system uses a fancy array of protecting mechanisms to regulate and typically eliminate these organisms and toxins. A general feature of the system is that these mechanisms have confidence detection structural options of the infectious agent that mark it as distinct from host cells. Such host-pathogen or host-toxin discrimination is crucial to allow the host to eliminate the threat while not damaging its own tissues [2,5-7].

THE ORGANS OF THE IMMUNE SYSTEM

a. Bone Marrow

b. Thymus

c. Spleen

d. Lymph Nodes

a) Bone Marrow

By the process of hematopoiesis all the cells of the immune system originated from the bone marrow. The bone marrow produces B cells, natural killer cells, granulocytes and immature thymocytes, additionally to red blood cells and platelets [8,9].

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b)Thymus

The function of the thymus is to supply mature T cells. Immature thymocytes leave the bone marrow and migrate into the thymus. Through a stimulating maturation method generally noted as thymic education, T cells that are useful to the immune system are spared, while those T cells that may evoke a harmful response are eliminated. The mature T cells are then moved to the bloodstream [8-15].

c) Spleen

The spleen, an immunologic filter of the blood made up of B cells, T cells, macrophages, dendritic cells, natural killer cells and red blood cells. An immune response is initiated once the scavenger or nerve fiber presents the antigen to the suitable B or T cells. This organ will be thought of as an immunologic center. Within the spleen, B cells become activated and produce large amounts of antibody [16-21].

d) Lymph Nodes

The lymph nodes perform as an immunologic filter for the lymph, a bodily fluid. Lymph Nodes composed mostly of T cells, B cells, nerve fiber cells and macrophages, the nodes drain fluid from most of our tissues. Antigens are filtered out of the lymph in the lymph node before returning the lymph to the circulation. In a similar fashion as the spleen, the macrophages and dendritic cells capture antigens present these foreign materials to T and B cells, consequently initiating an immune response [22-25].

The Cells of the Immune System

a) **T-Cells**

b) **Natural Killer Cells**

c) **B Cells**

d) **Granulocytes or Polymorphonuclear (PMN) Leukocytes**

e) **Macrophages**

f) **Dendritic Cells**

a) T-Cells

T lymphocytes are usually divided into two major subsets:-

i) CD_4+ T cell

ii) CD8+ T cell

CD_4+ T cell, is a pertinent coordinator of immune regulation.

Function:

T helper cell is to augment or potentiate immune responses.

CD8+ T cells important in down-regulation of immune responses [26-35].

b) Natural Killer Cells

Function:-

As effector cells that directly kill certain tumors such as melanomas, lymphomas and viral-infected cells, most notably herpes and cytomegalovirus-infected cells [36-42].

c) B Cells

Function:-

Antibodies in response to foreign proteins of microorganisms, viruses, and tumor cells were produced by B-Lymphocytes. Antibodies are specialized supermolecules that specifically recognize and bind to one particular protein that specifically recognize and bind to one particular protein [37,38].

d) Granulocytes or Polymorphonuclear (PMN) Leukocytes

Granulocytes are composed of three cell types

i) Neutrophils

ii) Eosinophils and

iii) Basophils

Function:-

Removal of bacteria and parasites from the body by engulfing these foreign bodies and degrade them using their enzymes[40,33].

e) Macrophages

Function:-

For the regulation of immune responses, Macrophages play an important role. Because of their pick up and ingest foreign materials they were referred as Scavengers or Antigen Presenting cells [41-44].

f) Dendritic Cells

Function:-

Dendritic Cells mainly captures antigen and move it to the lymphoid organs where an immune response is initiated [45].

TYPES OF IMMUNE SYSTEM

There are two types of Immune system.

i) Innate immune system

ii) Adaptive immune system

Innate immune system

The innate immune system consists of cells and proteins which are ready to mobilize and fight microbes at the site of infection. Broadly outlined, the innate system includes all aspects of the host's immune defense mechanisms that are encoded in their mature purposeful forms by the germ line genes of the host. These include physical barriers, like somatic cell layers that express tight cell-cell contacts (tight junctions, cadherin-mediated cell interactions, and others); the secreted mucus layer that overlays the epithelial tissue within the metabolic process, channel, and genital organs; and therefore the animal tissue cilia that sweep away this mucus layer, allowing it to be perpetually invigorated once it's been contaminated with ingested particles [46-50].

The main components of the innate immune system are 1) physical epithelial barriers, 2) phagocytic leukocytes, 3) dendritic cells, 4) a special type of lymphocyte called a natural killer (NK) cell, and 5) circulating plasma proteins.

The innate response additionally includes soluble proteins and bioactive tiny molecules that either constitutively in biological fluids or that is free from cells as they're activated. Lastly, the innate system includes membrane-bound receptors and cytoplasmic proteins that bind molecular patterns expressed on the surfaces of invasive microbes [51-55].

Adaptive immune system

The adaptive immune system is called into action against pathogens that are able to evade or overcome innate immune defenses. Components of the adaptive immune system are normally silent.

However, when activated, these components "adapt" to the presence of infectious agents by activating, proliferating, and creating potent mechanisms for neutralizing or eliminating the microbes. There are two types of adaptive immune responses: Humoral immunity and Cell-mediated immunity.Humoral immunity is mediated by antibodies produced by B lymphocytes and cell-mediated immunity, mediated by T lymphocytes [56-60].

CONCLUSION

Finally concluded that immune system is an interactive network of lymphoid organs, cells, humoral factors, and cytokines.

REFERENCES

1. Roitt I, Brostoff J, Male D. Immunology (second edition). J.B. Lippincott Co., 1989.
2. AMFAR, AIDS/HIV Treatment Directory, 1993; 6.
3. Mosmann TR, Coffman RL.TH1 and TH2 cells: Different patterns of lymphokine secretion lead to different functional properties. Annual Review of Immunology. 1989; 7: 145-173.
4. Yarchoan R, Mitsuya H, Broder S. Challenges in the therapy of HIV infection. Immunology Today. 1993; 14: 303-309.
5. Wood R, et al. Safety and efficacy of polyethylene glycolmodified interleukin-2 and zidovudine in human immunodeficiency virus type 1 infection: a phase I/II study. J of Inf Dis. 1993; 167: 519-525.
6. Francis ML, Meltzer MS, Gendelman HE. Interferons in the persistence, pathogenesis, and treatment of HIV infection. AIDS Res Human Retroviruses. 1992; 9: 199-207.

7. Hiemstra PS. The role of epithelial beta-defensins and cathelicidins in host defense of the lung. Exp Lung Res. 2007; 33: 537–542.

8. Holmskov U, Thiel S, Jensenius JC. Collectins and ficolins: humoral lectins of the innate immune defense. Annu Rev Immunol. 2003; 21: 547–578.

9. Sjoberg AP, Trouw LA, Blom AM. Complement activation and inhibition: a delicate balance. Trends Immunol. 2009; 30: 83–90.

10. Bonilla FA and Oettgen HC. Adaptive immunity. J Allergy Clin Immunol. 2010; 125: S33–S40.

11. Schroeder HW and Cavacini L. Structure and function of immunoglobolins. J Allergy Clin Immunol. 2010; 125: S41–S52.

12. Huston DP. The biology of the immune system. JAMA. 1997; 278: 1804–1814.

13. Robin C,et al. Human placenta is a potent hematopoietic niche containing hematopoietic stem and progenitor cells throughout development. Cell Stem Cell. 2009; 5: 385–395.

14. Rahmani S, Demmouche A. Iron Deficiency Anemia in Children and Alteration of the Immune System. J Nutr Food Sci. 2014; 4:333.

15. Ventegodt MD. The Art of Preventive Medicine: How can we Improve our Immune System and Help our Cells Keep their Order in our Body so we can Stay Healthy and Live Long and Happy Lives? Altern Integ Med. 2015; 4:e115.

16. Rivera-Amill V.The Human Microbiome and the Immune System: An Ever Evolving Understanding. J Clin Cell Immunol. 2014; 5:e114.

17. Qi F, et al. Immune-Based Modulation of Adult Hippocampal Neurogenesis, Link to Systemic Th1/Th2 Balance. J Vaccines Vaccin. 2015; 6:274.

18. Cunningham-Rundles S. Effects of nutritional status on immunological function. Am J Clin Nutr. 1982; 35: 1202-1210.

19. Chandra RK. Reduced bactericidal capacity of polymorphs in iron deficiency. Arch Dis Child. 1973; 48: 864-866.

20. Bhaskaram C, Reddy V. Cell-mediated immunity in iron- and vitamin-deficient children. Br Med J. 1975; 3: 522.

21. Kramer JL, Baltathakis I, Alcantara OS, Boldt DH. Differentiation of functional dendritic cells and macrophages from human peripheral blood monocyte precursors is dependent on expression of p21 (WAF1/CIP1) and requires iron. Br J Haematol. 2002; 117: 727-734.

22. Collins HL. The role of iron in infections with intracellular bacteria. Immunol Lett. 2003; 85: 193-195.

23. Beard JL. Iron biology in immune function, muscle metabolism and neuronal functioning. J Nutr. 2001; 131: 568S-579S.

24. Chandra RK. Lymphocyte subpopulations in human malnutrition: cytotoxic and suppressor cells. Pediatrics 1977; 59: 423-427.

25. Joynson DH, Walker DM, Jacobs A, Dolby AE. Defect of cell-mediated immunity in patients with iron-deficiency anaemia. Lancet. 1972; 2: 1058-1059.

26. Ekiz C, et al. The effect of iron deficiency anemia on the function of the immune system. Hematol J. 2005; 5: 579-583.

27. Markel TA, et al. The struggle for iron: gastrointestinal microbes modulate the host immune response during infection. J Leukoc Biol. 2007; 81: 393-400.

28. Klebanoff SJ. Intraleukocytic microbicidal defects. Annu RevMed. 1971; 22: 39-62.

29. Higgs JM, Wells RS. Chronic mucocutaneous candidiazis: Associated abnormalities of iron metabolism. Br J Dermatol. 1972; 86 (Suppl 8): 88.

30. Dallman PR. Iron deficiency and the immune response. Am J Clin Nutr. 1987 46: 329-334.

31. Van Heerden C, et al. Evaluation of neutrophil and lymphocyte function in subjects with iron deficiency. S Afr Med J. 59: 111-113.

32. Kochanowski BA, Sherman AR. Phagocytes and lysozyme activity in granulocytes from iron deficient rat pups. Nutr Res. 1984; 4: 511-520.

33. Hallquist NA, McNeil LK, Lockwood JF, Sherman AR. Maternal-iron-deficiency effects on peritoneal macrophage and peritoneal natural-killer-cell cytotoxicity in rat pups. Am J Clin Nutr. 1992; 55: 741-746.

34. Spear AT, Sherman AR. Iron deficiency alters DMBA-induced tumor burden and natural killer cell cytotoxicity in rats. J Nutr. 1992; 122: 46-55.

35. Kuvibidila SR, Kitchens D, Baliga BS. In vivo and in vitro iron deficiency reduces protein kinase C activity and translocation in murine splenic and purified T cells. J Cell Biochem. 1999; 74: 468-478.

36. Sussman M. Iron and infection. In: Iron in Biochemistry and Medicine (Jacobs, A. & Worwood, A. M., edn), Academic Press, New York, NY. 1974.

37. Addison GM, et al. An immunoradiometric assay for ferritin in the serum of normal subjects and patients with iron deficiency and iron overload. J Clin Pathol. 1972; 25: 326-329.

38. Canonne-Hergaux F, Gruenheid S, Govoni G, Gros P. The Nramp1 protein and its role in resistance to infection and macrophage function. Proc Assoc Am Physicians. 1999; 111: 283-289.

39. Hall A, et al. Anaemia in schoolchildren in eight countries in Africa and Asia. Public Health Nutr. 2001; 4: 749-756.

40. Hallberg L. Iron nutrition in health and disease. John Libbey edn, London.1996; 364.

41. OMS/UNICEF, Joint statement: focusing on anemia towards an integrated approach for effective anaemia control; (OMS). 2004.

42. Oski FA. Iron deficiency in infancy and childhood. N Engl J Med. 1993; 329: 190-193.

43. Feng XB, Yang XQ, Shen J. Influence of iron deficiency on serum IgG subclass and pneumococcal polysaccharides specific IgG subclass antibodies. Chin Med J (Engl). 1994; 107: 813-816.

44. Bagchi K, Mohanram M, Reddy V. Humoral immune response in children with iron-deficiency anaemia. Br Med J. 1980; 280: 1249-1251.

45. Kulapongs P, Vithayasai V, Suskind R, Olson RE. Cell-mediated immunity and phagocytosis and killing function in children with severe iron-deficiency anaemia. Lancet. 1974; 2: 689-691.

46. Moore LL, Humbert JR. Neutrophil bactericidal dysfunction towards oxidant-radical sensitive microorganisms during experimental iron deficiency. Pediatr Res. 1984; 18: 789-794.

47. Walter T, Arredondo S, ArÃ©valo M, Stekel A. Effect of iron therapy on phagocytosis and bactericidal activity in neutrophils of iron-deficient infants. Am J Clin Nutr. 1986; 44: 877-882.

48. Yetgin S, Altay C, Ciliv G, Laleli Y. Myeloperoxidase activity and bactericidal function of PMN in iron deficiency. Acta Haematol. 1979; 61: 10-14.

49. Vijay Kumar. Tumor Microenvironment and Immune System: Sworn Enemies Living Together. J Blood Lymph. 2013; S1:e001.

49. Gupta S. Molecular mechanisms of apoptosis in the cells of the immune system in human aging. Immunol Rev. 2005; 205: 114-129.

50. Jefferson T, et al. Vaccines for preventing influenza in healthy adults. Cochrane Database Syst Rev. 2014.

51. Anderson EF Peyote. The divine cactus. Tucson, AZ: Univ Arizona Press. 1996.

52. Castaneda C. The teachings of Don Juan: A yaqui way of knowledge. New York. 1968.

53. Antonovsky A. Health, stress and coping. London, Jossey-Bass.1985

54. Antonovsky A. Unravelling the mystery of health. How people manage stress and stay well. San Francisco: Jossey-Bass. 1987.

55. www.encyclopedia.com › People › Medicine › Medicine: Biographies

56. Gøtzsche PC. Psychiatry has gone astray We would be much better off if we took away all psychotropic drugs from the market, The physicians are not able to handle them. 2014.

57. Gøtzsche P. Deadly Medicines and Organised Crime: How Big Pharma Has Corrupted Healthcare, New York. 2013.

58. Ventegodt S, Merrick J. Textbook on Evidence-Based Holistic Mind-Body Medicine: Basic Principles of Healing in Traditional Hippocratic Medicine, New York: Nova Science. 2012.

59. Ventegodt S, Merrick J. Textbook on Evidence-Based Holistic Mind-Body Medicine: Research, Philosophy, Economy and Politics of Traditional Hippocratic Medicine, New York: Nova Science. 2013.