



IMMUNE & LYMPHATIC SYSTEMS

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Certification Level 2 Training
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THE IMMUNE & LYMPHATIC SYSTEMS - AGENDA



IMMUNE SYSTEM
INTRODUCTION



OVERVIEW OF
IMMUNE SYSTEM



IMMUNE SYSTEM
DISORDERS



OVERVIEW OF
LYMPHATIC SYSTEM



LYMPHATIC SYSTEM
DISORDERS



QUESTIONS?



THE IMMUNE SYSTEM

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- The immune system protects animals from outside invaders. Things like Bacteria, Viruses, fungi, Toxins, etc. It is made up of different organs, cells, and proteins that all work together.
 - This network consists of white blood cells, antibodies and other substances that fight off infections and reject foreign proteins.
 - The thymus gland and bone marrow are the sites where white blood cells are produced.
 - The Spleen, Lymph nodes, and Liver trap microorganisms and foreign substances and provide a place for immune system cells to collect, interact (with each other and with foreign substances) and generate an “immune response.”
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THE IMMUNE SYSTEM - INTRODUCTION



THE IMMUNE SYSTEM - INTRODUCTION

- The primary role of the immune system is to defend the body against foreign invaders or abnormal cells that invade or attack it.
 - To do this, the immune system must be able to distinguish “Self” From “Non-Self”
 - Microorganisms, chemicals, or foreign substances are “non-self” and if the body recognizes these as foreign, it can protect itself from an attack.
- Antigens are the substances that stimulate and immune response within the body. Antigens may be contained within or on bacteria, viruses, microorganisms, or cancer cells. Or they can exist on their own as pollen or food molecules.
- A normal immune response consists of recognizing a foreign antigen, mobilizing forces (cells) to defend against it, and attacking it.

3 LINES OF DEFENSE AGAINST INVADERS

Physical
Barriers

Nonspecific
(or Innate)
Immunity

Specific (or
Adaptive)
Immunity



PHYSICAL BARRIERS

- Skin
- Cornea (of the eye)
- Mucous Membranes lining the Respiratory, Digestive, Urinary, and Reproductive Tracts
- The ability to Cough or Sneeze
- Healthy (Commensal) microbes in the gut and on the skin
- Secretions containing enzymes that can destroy harmful bacteria
 - Tears (eyes)
 - Digestive Tract secretions
 - Saliva
 - Mucous in the Airways

NONSPECIFIC (INNATE) IMMUNITY

- Present at Birth
- Acute inflammation is the central feature of innate immunity – treats all invaders the same way
- White Blood Cells, such as neutrophils and macrophages travel from the blood into the tissues to kills invading organisms and remove the injured cells
- Other white blood cells (monocytes, eosinophils, basophils and natural killer cells) – each work in their own way to identify and destroy invaders.
- The Complement system is also involved. Tissues contain peptides that can bind and kill invaders through enzymatic processes
- Cytokines are molecules produced by certain cells that can act on liver cells, and target invaders as well.

SPECIFIC (ACQUIRED OR ADAPTIVE) IMMUNITY

- Improves over time. As the immune system encounters different antigens, it learns the best way to attack each time and develops a memory for that antigen.
- It tailors each attack based on the specific antigen it previously encountered.
- This takes time to develop after the initial exposure to a new antigen, but each time it is encountered, the immune response gets more rapid and more effective.
- Specific immunity involves lymphocytes (B cells and T cells), antibodies, antigen-presenting cells, and cytokines
- *This is how vaccines work*
- 2 types of Specific/ Acquired Immunity
 1. Antibody immunity (Also called Humoral Immunity)
 2. Cell-Mediated immunity – for combatting intracellular invaders such as viruses and some intracellular bacteria

MOUNTING AN IMMUNE RESPONSE

Immune system recognizes invader due to cell markers on the cell surface (Antigens)

White Blood Cells recognize the antigen directly, attaches to it, and produces antibodies which stop it from multiplying or infecting other cells (“Neutralization”)

Antibodies also label the foreign invaders so other immune defenses can find them more easily.

Once an infection has been eliminated, most of the immune cells disappear, but a few stick around as memory cells – The next time that invader comes around, the body can respond more quickly and with a stronger attack.

SPECIALIZED CELLS AND MOLECULES OF THE IMMUNE SYSTEM

Lymphocytes	Small white blood cells found in all organs and tissues. There are 2 principal types: B lymphocytes (B cells), which mature in the bone marrow, and T lymphocytes (T cells), which mature in the thymus.
B cells	These lymphocytes are responsible for the production of antibodies, an important part of the immune response.
T cells	These lymphocytes include killer (cytotoxic) T cells , which detect and kill cells that are abnormal (such as cancer cells), and helper T cells , which help other lymphocytes mount an immune response.
Antigens	Any substances that can induce an immune response.
Antigen-presenting cells	Specialized cells that engulf antigens and process them so that they can be recognized by lymphocytes.
Neutrophils	All-purpose scavenger cells that ingest and destroy antigens and cell debris.
Macrophages	White blood cells that stimulate healing and remove antigens, injured cells, and neutrophils from tissue.
Eosinophils	White blood cells that ingest bacteria and other foreign cells, participate in allergic reactions, and help destroy cancer cells.
Mast cells	Cells that release histamine and other substances involved in allergic reactions.
Cytokines	The immune system's messengers, typically small proteins, which help regulate an immune response by delivering signals from one cell to another.
Antibodies	Also called immunoglobulins , antibodies are proteins produced by B cells that interact with specific antigens. They can form immune complexes, label antigens for removal by other cells, or block the ability of a virus to enter its target cell.



IMMUNE SYSTEM DISORDERS

IMMUNE-MEDIATED DISEASE

IMMUNE-MEDIATED DISEASE

Underactive:
Immunodeficiency

Overactive |
Excessive:
Autoimmune
Disorder

Overreacting to
chemicals or
proteins:
Hypersensitivity or
Allergic Reactions



IMMUNODEFICIENCIES

- Primary Immunodeficiencies – unlikely to see
- Secondary Immunodeficiencies
 - Viral Induced (FeLV, FIV) – Anti-viral, Anti-microbial, Anti-inflammatory oils, and Adaptogens

EXCESSIVE NONSPECIFIC (INNATE) RESPONSES

- Septic Shock in response to severe infection or injuries
 - Fever, Low blood pressure, Abnormal Blood clotting, multiple organ failure, Death.
- Rheumatoid Arthritis
 - Uncontrolled inflammation around the joints
- Idiopathic Polyarthrititis
 - Common in large dogs (German Shepherds, Doberman Pinschers, Retrievers, Spaniels, Pointers)
- Work with a veterinarian.
- Oils that May Help: Anti-inflammatory oils – Frankincense, Turmeric, Ginger, Lavender, Basil

EXCESSIVE SPECIFIC (ADAPTIVE) RESPONSES

- 4 Types, based on the mechanisms involved.
 - Type I Reactions – Atopic disease, Anaphylactic Reactions
 - Type II Reactions – Antibody-mediated Cytotoxic Reactions
 - Type III Reactions – Immune Complex Disease
 - Type IV Reaction – Cell Mediated Immune Reactions
- Can Lead to Inflammation, Tissue Damage, Autoimmunity, or Amyloidosis

TYPE I REACTIONS - ATOPIC DISEASE, ANAPHYLACTIC REACTIONS

- Immediate hypersensitivity – nonparasitic antigens (allergens)
 - Severity depends on the type of antigen, the amount of antigen, route of exposure, etc.
- Hives
- Allergic rhinitis
- Chronic Allergic Bronchitis
- Allergic Asthma
- Food Allergies
- Atopic dermatitis (environmental allergies, including sweet itch)

- Oils to reach for: Antihistamine oils, Anti-inflammatory oils, Adaptogens, & system specific support depending on the system involved (respiratory, integumentary, digestive, etc.)



TYPE II REACTIONS – ANTIBODY-MEDIATED CYTOTOXIC REACTIONS

- Occur when an antibody binds to an antigen present on the surface of the cell
- Typically involve Blood Cells
- IMHA and Thrombocytopenia
- Autoimmune skin disorders: Pemphigus
- Essential Oils: Cellular support oils, Anti-inflammatory oils, Adaptogens, symptomatic system support, Frankincense, Copaiba, Helichrysum, Geranium, Rose, Wild Orange, Lemon, Chamomile, Ginger, Cinnamon

TYPE III REACTIONS – IMMUNE COMPLEX DISEASE

- Antigen-antibody complexes deposit in tissues causing inflammation
- Systemic Lupus Erythematosus (SLE)
- Vasculitis
- Purpura hemorrhagica (Strangles in horses)
- Anterior uveitis | Equine recurrent uveitis (ERU)
- Can be caused by certain reactions to Leptospira, Toxoplasma, FIP, or Infectious Canine Hepatitis
- Essential Oils to address the underlying condition, system support, and Anti-inflammatory and Adaptogen oils.

TYPE IV REACTION – CELL MEDIATED IMMUNE REACTIONS

- Excessive response to intracellular viruses or bacteria or sometimes chemical
- Granulomas (certain microorganisms cause these)
- Old-dog encephalitis (dormant distemper virus)
- Allergic Contact hypersensitivity – not just plants like poison ivy, but also food dishes, plastic collars, topical medications
- Address underlying cause, remove antigen if possible, support system involved (often skin) with Anti-inflammatory oils, regenerative oils, adaptogens.



TUMORS OF THE IMMUNE SYSTEM

- Cells throughout the immune system may become neoplastic
 - Lymphoma
 - Leukemia
 - Thymomas
- Anti-tumoral | Anti-cancer oils, anti-inflammatory oils, Adaptogens

A microscopic view of lymphatic tissue, showing a dense network of cells and fibers. The tissue is stained with hematoxylin and eosin (H&E), resulting in a purple and pink color scheme. The cells are arranged in a complex, interconnected pattern, with many small, round cells and larger, more elongated cells. The overall appearance is that of a highly organized and dense cellular structure.

THE LYMPHATIC SYSTEM

THE LYMPHATIC SYSTEM - INTRODUCTION

- The lymphatic system is closely associated with the circulatory system and the immune system. It is often included in the circulatory system discussions
- The function of the lymphatic system is to remove excess tissue fluid, transport waste materials to the bloodstream, filter lymphatic fluid, and transport proteins and enzymes to the bloodstream
- Primary lymphoid tissues includes the bone marrow and thymus, and secondary lymphoid tissue includes the lymph nodes, spleen, and gastrointestinal-associated lymphatic tissue (GALT) – these are all connected via a network of vessels that carry lymph (lymphatic fluid) back to the bloodstream.
- Lymph vessels are very thin walled, with multiple one-way valves, which help to maintain normal lymphatic flow and fluid levels around the body. These vessels are surrounded by smooth muscle tissue, which contracts and helps push lymphatic fluid through these vessels
- Lymphatic fluid is formed from the tissue between cells, which it starts to accumulate (Called Chyle from the GI tract – contains multiple fat particles called chylomicrons)
- The lymphatic system serves as a storage unit and filtering cleanser of the body

THE BONE MARROW

Made up of Red Marrow and Yellow Marrow

Red Marrow: Where the majority of blood cells are made – originating from stem cells.

Yellow Marrow: increased amounts of fat tissue

THE THYMUS

Important for
immune function,
especially in
younger animals

NOT the Thyroid!!!

Gradually
replaced by fat
tissue as an
animal ages



LYMPHOCYTES

- White blood cells within the lymphatic system.
- Important in immunity
- Develop from Hematopoietic stem cells in the bone marrow to form either B- or T- lymphocytes (B lymphocytes mature in the Bone marrow, and T lymphocytes mature in the Thymus)

LYMPH NODES

- Kidney bean shaped
- Located along the lymph vessels
- Filter the lymphatic fluid
- Stimulate lymphocytes to create antibodies and destroy cells



THE SPLEEN

- The largest lymphoid organ in the body
- Made up of red and white pulp – the red pulp deals with the red blood cells, and the white pulp contains the lymphoid tissue
- Red pulp stores blood, removes dead or abnormal RBCs, is made up of blood vessels, blood storage sinuses, and macrophages
- White pulp clones lymphocytes during an immune response
- The spleen can store up to 20% of the body's blood volume, which it can release via splenic contraction when RBCs are needed



GALT

- Lymphocytes are in the mucosa of the GI tract
- Lymphatic vessels run throughout the GI tract and are present throughout each villus within the intestine. These vessels absorb dietary fats as well as lymphatic fluid

LYMPHATIC SYSTEM DISEASES

- Lymphadenopathy – enlarged lymph nodes
- Lymphadenitis – inflammation of the lymph nodes – usually from a bacteria, virus, fungi or parasite but also from chemical or toxin exposure
 - Oils: Antimicrobial oils targeted at the specific microbe, Anti-inflammatory oils
- Lymphoma or Lymphosarcoma – cancer of lymphoid tissue – can be anywhere in the body
 - Oils: Antitumoral | Anticancer oils, anti-inflammatory oils, adaptogens
- Lymphocytic Leukemias – cancer cells in the bone marrow and blood
 - Oils: Antitumoral | Anticancer oils, anti-inflammatory oils, adaptogens
- Lymphedema | Lymphangiectasia – fluid build up in tissues and the lymphatic system is damaged or blocked so they do not drain properly. May be complicated by underlying conditions like CHF, trauma, infection, tumors
 - Oils: Circulatory support oils, Diuretics, address underlying condition if known, Anti-inflammatory oils.

QUESTIONS?

