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A Review Concept Auto Immune Diseases



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ABSTRACT

The biomedical science of immunology examines how an organism's immune system reacts to an original chemical and how it works. The immune response is a biological mechanism that recognizes and gets rid of antigen substances in addition to being the body's reaction to antigen stimulation. Many immune system components are cellular in origin and are not connected to any particular organ; instead, they are distributed or embedded in different body tissue. Many medical specialties, including organ transplantation, cancer, rheumatology, virology, bacteriology, parasitology, and dermatology can benefit from immunology. Innate immunity and adaptive immunity are the immune system's two primary lines of defense against infections, in addition to structural and chemical barriers. Conversely, adaptive immunity is both antigen-specific and antigen-dependent. It possesses the ability to memorize antigens, allowing the host to produce a more effective and quick immune response the next time the antigen is encountered.



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INTRODUCTION

Immunology is a vital area of the biological and medical sciences that studies the immune system. The immune system uses a number of defense mechanisms to keep us safe from illness. Diseases including cancer, allergies, and autoimmunity can arise from an immune system that is not operating properly. Additionally, it is now evident that immune responses play a role in the emergence of other prevalent illnesses that were not previously thought to be immunologic, such as metabolic, cardiovascular, and neurodegenerative diseases like Alzheimer's.(1) The immune response is a biological mechanism that recognizes and gets rid of antigen substances in addition to being the body's reaction to antigen stimulation. Many immune system components are cellular in origin and are not connected to any particular organ; instead, they are distributed or imbedded in different bodily tissues Many medical specialties, including organ transplantation, cancer, rheumatology, virology, bacteriology, parasitology, and dermatology, can benefit from immunology(2). The existence of antibodies (produced by B lymphocytes) and T cells that are directed against a person's natural constituents (autoantigens) is known as autoimmunity. Known as autoantigens or self-antigens, these constituents are mainly proteins (or proteins complexed with nucleic acids).” Autoantibodies” and “autoreactive T cells” are the names for the antibodies and T cells that are able to identify autoantigens.(28)

TYPE

The immune system is composed of both molecular and cellular elements. These elements serve two purposes: responding responses, which are adapted to certain diseases, and nonspecific mechanisms, which are innate to an organism. Examining the elements that comprise the innate And adaptive immune systems is the focus of fundamental, or classical, immunology. (1)

Innate immune system

The initial line of defense is innate immunity, which is nonspecific. In other words, regardless of how distinct a possible disease may be, the reactions are always the same. Physical barriers like skin and saliva as well as cells like mast cells neutrophils, basophils, and macrophages are examples of innate immunity. These components 'are ready to go' and protect an organism for the first few days of infection. In some cases, this is enough to clear the pathogen, but in other instances the first defence becomes overwhelmed and a second line of defence kicks in.(1) Important function of innate immunity is the rapid recruitment of

immune cells to sites of infection and inflammation through the production of cytokines and chemokines (small proteins involved in cell–cell communication and recruitment). Cytokine production during innate immunity mobilizes many defense mechanisms throughout the body while also activating local cellular responses to infection or injury. Key inflammatory cytokines released during the early response to bacterial infection are: tumour necrosis factor(TNF),interleukin1(IL-1)aiinterleukin6(IL-6). These cytokines play a crucial role in the recruitment of new cells and the local inflammation that is necessary for the removal of numerous infections. They also have a role in the onset of fever. They are crucial therapeutic targets because inflammatory or autoimmune diseases are frequently linked to the dysregulated production of these inflammatory cytokines.(3) It is occasionally referred to as the “nonspecific” immune system because of the uniform manner it reacts to all pathogens and foreign substances. It takes action very fast. For example, it ensures that within a few hours, bacteria that have penetrated the skin through a minor wound are found and eliminated immediately. However, the ability of the innate immune system to prevent the spread of pathogens is restricted.(4)

It consists two types:

1. Protection offered by skin and mucus member.
2. Protection offered by immune cells and protein

Adaptive immune system

The second line of defense, known as adaptive immunity, entails accumulating memory of infections in order to create an improved response that is particular to the pathogen or foreign material. Antibodies that are part of adaptive immunity typically target foreign pathogens that are free to roam the bloodstream. T cells are also involved; these cells are specifically targeted by infections that have colonized cells and have the ability to either kill infected cells directly or regulate the antibody response.(1) Effective immunization against infectious illnesses is predicated on adaptive immune responses. The adaptive immune system consists of two types of cells: B cells that develop into plasma cells and make antibodies, and antigen-specific T cells that multiply when activated by APCs.(3)

PATHOGENIC CLASSIFICATION OF AUTO IMMUNE DISEASES

Immune dependent system Primary immune-deficiencies, malignant neoplasms, and allergy illnesses are the three categories of immune-dependent diseases. The primary pathogenetic

pathway involves immune system problems. Immunotropic therapy is the primary treatment approach.

Immune association disease –

Immune associated disease can be classified as: secondary immune-deficiencies, infections, somatic and other pathological processes, and allergic complications, which are based on the formation of secondary disorders of the immune system, requiring auxiliary immunotropic treatment Auto immune diseases.

1. Type 1 diabetes.
2. Myasthenia gravis.
3. Asthma
4. Allergy
5. Multiple sclerosis
6. Rheumatoid arthritis
7. Cancer

1. Type 1 diabetes

The hormone insulin, which aids in controlling blood sugar levels, is produced by the pancreas. When you have type 1 diabetes, your immune system attacks the cells in your that make insulin. (5) High blood sugar from type 1 diabetes can damage the blood vessels and organs. This can include.

- Heart
- Kidneys
- Eyes
- Nerves

Type 1 diabetes, once known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition. In this condition, the pancreas makes little or no insulin. Insulin is a hormone the body uses to allow sugar (glucose) to enter cells to produce energy. Different factors, such as genetics and some viruses, may cause type 1 diabetes. Although type 1 diabetes usually appears during childhood or adolescence, it can develop in adults. (6)

Symptoms

Type 1 diabetes symptoms can appear suddenly and may include (6).

- Feeling more thirsty than usual
- Urinating a lot
- Bed-wetting in children who have never wet the bed during the night
- Feeling very hungry
- Losing weight without trying
- Feeling irritable or having other mood changes
- Feeling tired and weak
- Having blurry vision

Causes

The exact cause of type 1 diabetes is unknown. Usually, the body's own immune system. Which normally fights harmful bacteria and viruses destroys the insulin-producing (islet) cells in the pancreas. Other possible causes include. (6)

- Genetics
- Exposure to viruses and other environmental factor

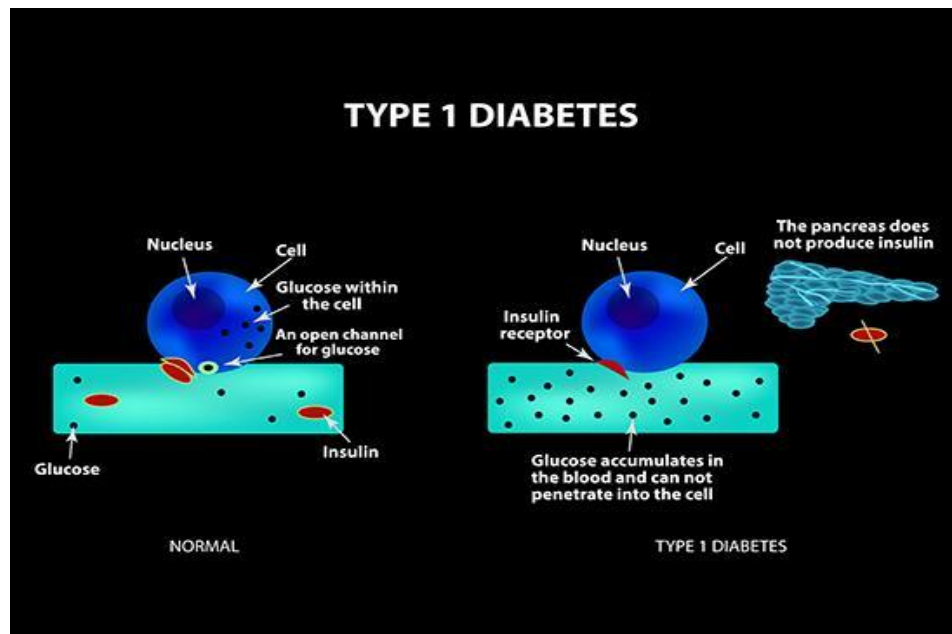


Fig .1 Type 1 Diabetes [26]

2. Myasthenia gravis

When your thyroid gland in your neck is attacked by Graves' disease, it over produces hormones. The body's metabolism, or how it uses energy, is regulated by thyroid hormones. Excessive levels of these hormones intensify our body's functions, leading to various symptoms such as: a fast heartbeat, or tachycardia intolerance to heat inadvertent weight loss goiter, or enlargement of the thyroid gland (5) myasthenia gravis (my-us-THEE-nee-uh gravis is), voluntary muscles become weak and fatigue easily. This is the result of a breakdown in nerve-muscle communication. A cure for myasthenia gravis does not exist. Symptom relief is possible with treatment. These symptoms can include double vision, drooping eyelids, weakness in the muscles of the arms or legs, and difficulty speaking, chewing, swallowing, or breathing.(7) Although this condition can afflict individuals at any age, it is more prevalent in women under 40 and in men over 60.(7)

Signs and symptoms

Myasthenia gravis causes muscular weakness that deteriorates with use of the affected muscle.(7)Muscle weakness can come and go because the majority of the time the symptoms improve with rest. But with time without symptoms usually worsen. Usually, a few years after the sickness starts, they get the worst of it. You could have myasthenia gravis and it's could damage any muscle you can control. Affected muscle group vary in frequency of occurrence. (7)

Causes



Fig .2 Myasthenia Gravis. [8]

Treatment

There is no treatment for MG. The goals of treatment are to control immune system activation and manage symptoms. Options for treatment may include:

Medication:

Medication helps lessen muscle weakness and stop the condition from getting worse. These may consist of

- Immunosuppressants and corticosteroids can both aid in reducing the body's erratic immunological response.

b) Cholinesterase inhibitors, including pyridostigmine (Mestinon), can facilitate better nerve-muscle transmission.

c) When adults test positive for the anticholinergic receptor (AChR) antibody, monoclonal antibodies such as eculizumab (Soliris) can help shield the neuromuscular junction from the harmful effects of acetylcholine antibodies.(10)

Thymus gland removal

Plasma exchange

Intravenous immune globulin

Lifestyle changes

3 Asthma

A crippling and occasionally fatal illness of the airways is asthma. It usually happens when the immune system reacts to airborne particles and over time, it can cause patients' airways to thicken. It is a leading cause of disease and is more common in kids. There may be an allergic component in certain cases, but the etiology is more complicated and poorly understood in many others.(1) Lung condition known as asthma, or bronchial asthma, is what causes breathing difficulties. Being a chronic (ongoing) condition, it requires constant medical attention and doesn't go away. Currently, about 25 million Americans suffer from asthma. Over 5 million youngsters are included in this total. If therapy for your asthma is not received, it may become fatal.(11) Normal breathing allows air to pass through your airways softly and readily because the muscles surrounding them are relaxed. Three things may transpire during an asthma attack:

Bronchospasm:

The muscles surrounding the airways contract or constrict. Your breathing becomes more difficult as they constrict. Airways that are narrowed. Cannot allow air to pass freely.

Inflammation:

Your airways' mucous lining swells. Less air can enter or exit your lungs due to swollen airways.

Mucus production:

The attack causes your body to produce extra mucus. The thick mucus. Obstructs the airways. The sound your airways make when you exhale is known as wheezing, and it occurs as your airways get more constricted. Another term for an asthma episode could be a flareup or an exacerbation. It's the phrase used to describe uncontrolled asthma. (11)

Symptoms

- Shortness of breath
- Cough
- Chest tightness or pain
- Wheeze (a whistling sound when you breathe)
- Waking at night due to asthma symptoms
- A drop in your peak flow meter reading (if you use one)(13)

Causes

Allergens and other irritants can cause exposure, which in turn can cause asthma symptoms and indications. (15) Individual differences exist in the triggers of asthma, which may include:

- Airborne allergens, such as pollen, dust mites, mold spores, pet dander or particles of cockroach waste
- Respiratory infections, such as the common cold
- Physical activity
- Cold Air pollutants and irritants, such as smoke (15)

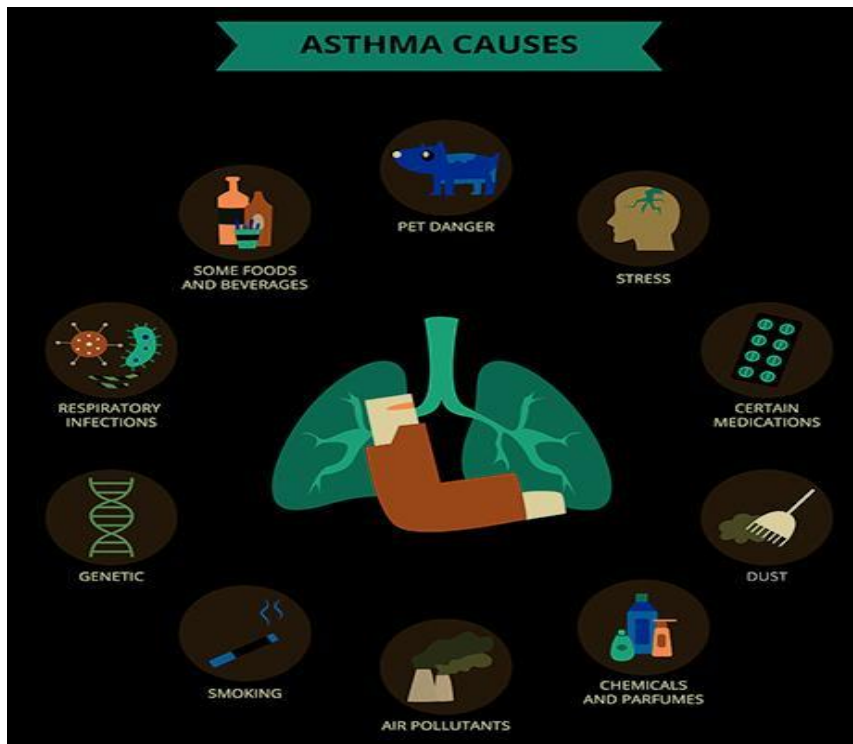


Fig.3 causes of Asthama [14]

4. Allergy

Allergies, also referred to as allergic disorders, are a group of illnesses brought on by the immune system's heightened sensitivity to normally innocuous environmental chemicals. Fever, food allergies, atopic dermatitis, allergic asthma, and anaphylaxis are some of these illnesses.(16) Body reacts to foreign proteins with allergies. These proteins, or allergens, are usually safe. On the other hand, your body's immune system overreacts to the presence of a protein if you have an allergy to it. Every year in the US, allergic reactions affect over 50 million people. In the US, they rank as the sixth most common cause of chronic illness.(15)

Symptoms

The most common allergic include: certain foods When your body reacts to a certain food, it releases an antibody that causes food allergies. Shortly after consuming the food, an allergic reaction happens, and the symptoms may be rather serious. Among the symptoms could be:

- a) Itching all over body (generalized pruritus)
- b) Itching in just one certain part of body (localized pruritus)
- c) Nausea and vomiting
- d) Hives

e) Swelling around the mouth, including throat and tongue or face

Anaphylaxis is one of the signs of an IgE-mediated food allergy. It could show up as any one of the aforementioned symptoms, or as a mix of them. It usually happens 30 minutes after eating the meal to which you are allergic. In adult most common food allergy include.(17)

1. Milk
2. Eggs
3. Wheat
4. Soy
5. Peanuts
6. Tree nuts
7. Shellfish

In children's most common food allergic include:

1. Milk
2. Egg
3. Wheat
4. Soy
5. Peanuts.
6. Treenuts

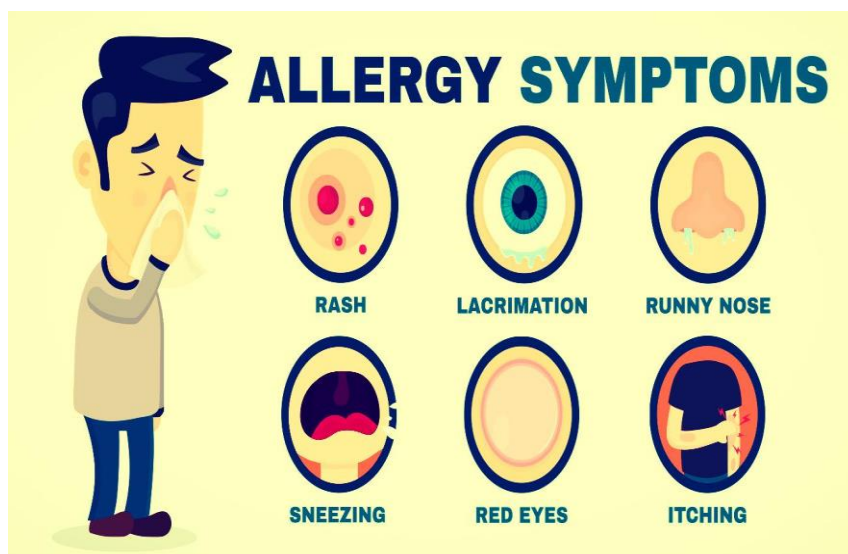


Fig .4 Symptoms [18]

5. Multiple Sclerosis

A long lasting (chronic) condition affecting the central nervous system is multiple sclerosis (MS). It is believed to be an autoimmune disorder, a condition when the body unintentionally targets itself. MS is a condition that strikes everyone differently and is unpredictable. Some MS patients may only have minor symptoms. When there is a breakdown in the communication between the brain and other body components, some people may lose their ability to walk, write, talk, or see well. (19) The lipid and protein material called myelin envelops and shields nerve fibers. Myelin is attacked by the immune system in multiple sclerosis, resulting in its widespread destruction. Sclerosis is the scar tissue that results from this myelin loss. Lesions or plaques are other names for these regions. This kind of damage prevents the nerves from carrying electrical impulses to and from the brain in a regular manner. Relapsing remitting MS is the term used to describe MS that attacks again and again. It is referred to as primary progressive MS when the symptoms worsen over time without obvious episodes. (19)

Symptoms

MS symptoms are frequently erratic. They could be transient or permanent, moderate or severe. The way they manifest varies based on the specific part of the neurological system that is impacted. The most prevalent MS symptoms are listed below. But the symptoms could vary from person to person. (19)

First symptoms of MC

- Blurred or double vision
- Red-green color distortion
- Pain and loss of vision because of swelling of the optic nerve (optic neuritis)
- Trouble walking and difficulty with balance
- An abnormal feeling, such as numbness, prickling, or pins and needles (paresthesia)

Other symptoms of MC (19)

- Muscle weakness in the arms and legs
- Trouble with coordination. You may have problems walking or standing. You may also be partly or completely paralyzed.

- Spasticity. This is the involuntary increased tone of muscles leading to stiffness and spasms.
- Fatigue. This may be brought on by physical activity. But it may ease with rest. You may have constant tiredness that doesn't go away.
- Loss of feeling
- Speech problems
- Tremor
- Dizziness
- Hearing loss
- Bowel and bladder problems
- Depression
- Changes in sexual function

Causes of multiple sclerosis

It is uncertain what causes multiple sclerosis. It is regarded as an immune mediated illness, meaning that the body's defense mechanism targets its own tissues. Myelin, the fatty substance that covers and shields nerve fiber in the brain and spinal cord, is destroyed in multiple sclerosis cases due to immune system abnormalities. Myelin is comparable to the insulating. Layer that covers electrical cables. Messages that travel along a nerve fiber may be slowed or inhibited when the protective myelin covering it is destroyed. Why some people develop MS and others do not is unknown. It seems that a mix of environmental and genetic factors are at play.(21)

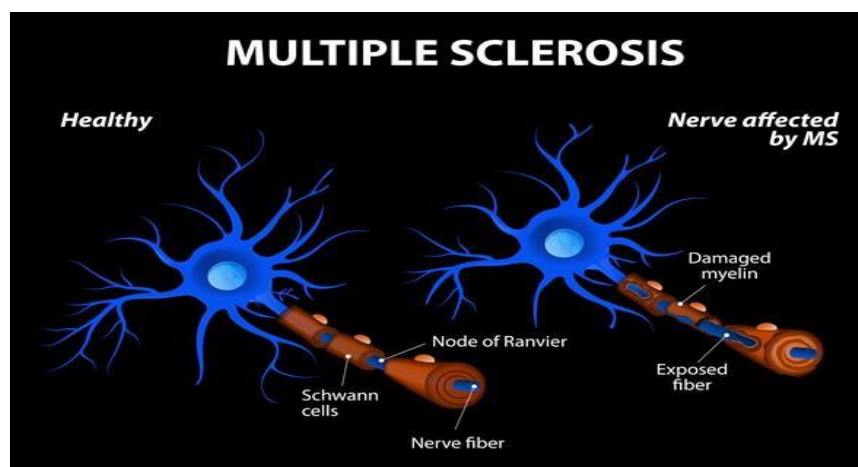


Fig. 5 [20]

6. Rheumatoid arthritis

Joint discomfort and inflammation are symptoms of rheumatoid arthritis (RA). It occurs when the synovium, the lining that lines the joints, is attacked by the immune system acting improperly. The hands, knees, or ankles are frequently affected by the condition, and it typically affects the same joint on both sides of the body, such as both hands or both knees. However, there are instances where RA also results in issues with the heart, circulatory system, eyes, and/or lungs. RA primarily affects women over males and typically appears in middle life for unexplained reasons. An increased risk of acquiring RA is associated with a family member's RA. (21)

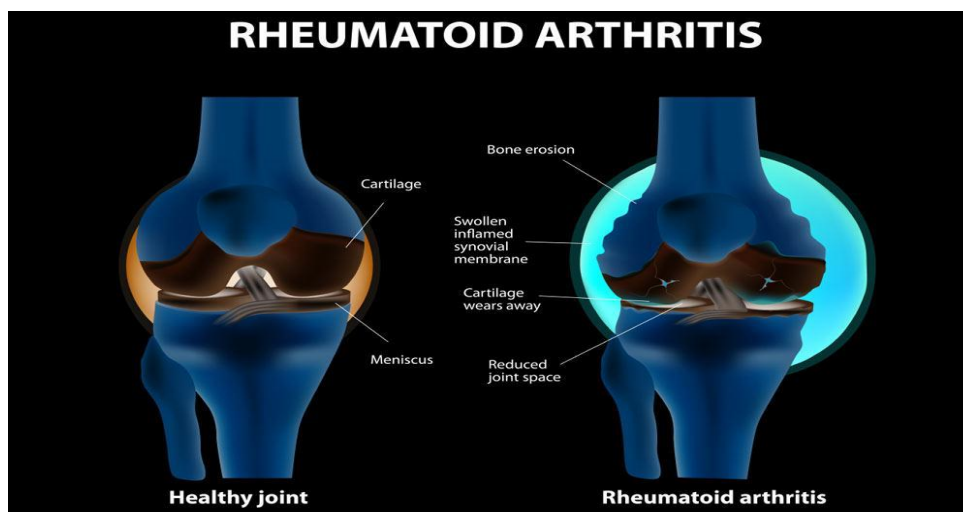


Fig .6 Rheumatoid Arthritis [23]

Although RA more frequently People are affected by Trusted Source as they age, but it can also begin in your 30s. Juvenile idiopathic arthritis is a similar illness that can develop in early infancy. (5)

Symptoms

This causes symptoms affecting the joints such as:

1. Swelling
2. Warmth Soreness
3. Stiffness
4. Fatigue
5. Weakness
6. Fever

Causes

It is unknown what specifically causes rheumatoid arthritis. Scientists believe a combination of environmental variables, hormones, and heredity. Is to blame. Your immune system often defends your body against illness. Something causes your immune system to target your joints when you have rheumatoid arthritis. A trigger could be an infection, smoking, or mental or physical stress.

7. Cancer

Cancer is a broad category of diseases that all share the characteristic of developing from normal cells into malignant cells that proliferate and spread. In the United States, cancer is the second most common cause of death. However, compared to 20 years ago, fewer individuals are dying from cancer. Cancer is being cured and cancer patients are living longer because to early detection and cutting-edge treatments. In an effort to help prevent cancer in people, medical researchers are also uncovering independent risk factors associated with the disease.(25) Cancer immunotherapy has demonstrated great potential as a new tool in our toolbox to fight the disease. It works by enhancing the immune system's natural ability to combat malignant tissue. The employment of monoclonal antibody proteins that seek for and bind directly to a particular target protein known as an antigen is one of the additional ways that immunological knowledge is applied to fight cancer.(1)

Types of cancer

1. Carcinoma

A carcinoma is a type of cancer that develops in the epithelial tissue that lines or covers the surfaces of organs, glands, or other bodily parts. For instance, a carcinoma is the medical term for a cancer that affects the stomach lining. A large number of carcinomas impact glands or organs involved in secretion, such the breasts that make milk. Eighty to ninety percent of cases of cancer are carcinomas. Types of carcinoma.

- Melanoma
- Basal cell carcinoma
- Squamous cell skin cancer
- Markel cell cancer

2. Sarcoma

A sarcoma is a type of cancerous growth that originates from connective tissues, including bones, cartilage, muscles, tendons, and fat. Young individuals are typically affected by the most frequent type of sarcoma, which is a bone tumor. Osteosarcoma (of the bone) and chondrosarcoma (of the cartilage) are two types of sarcoma.

Types of sarcoma

- Soft tissue sarcoma
- Osteosarcoma
- Ewing's sarcoma
- Chondrosarcoma

3. Lymphoma

A disease known as lymphoma can arise in the brain, breast, or lymphatic system's nodes or glands, which are responsible for producing white blood cells and purifying bodily fluids. Hodgkin's lymphoma and non Hodgkin's lymphoma are the two types of lymphomas. Types of Lymphoma:

- Hodgkin's lymphoma
- Non-hodgkin's lymphoma

4. Leukemia

commonly referred to as blood cancer, is a bone marrow malignancy that prevents the marrow from generating healthy red, white, and platelet blood cells To fend off infection, white blood cells are essential. Anemia cannot be prevented without red blood cells. The body is prevented from bleeding and bruising readily by platelets. Types of leukemia are

- Acute lymphocytic leukemia
- Acute myeloid leukemia
- Chronic lymphocytic leukemia
- Chronic myeloid leukemia(26

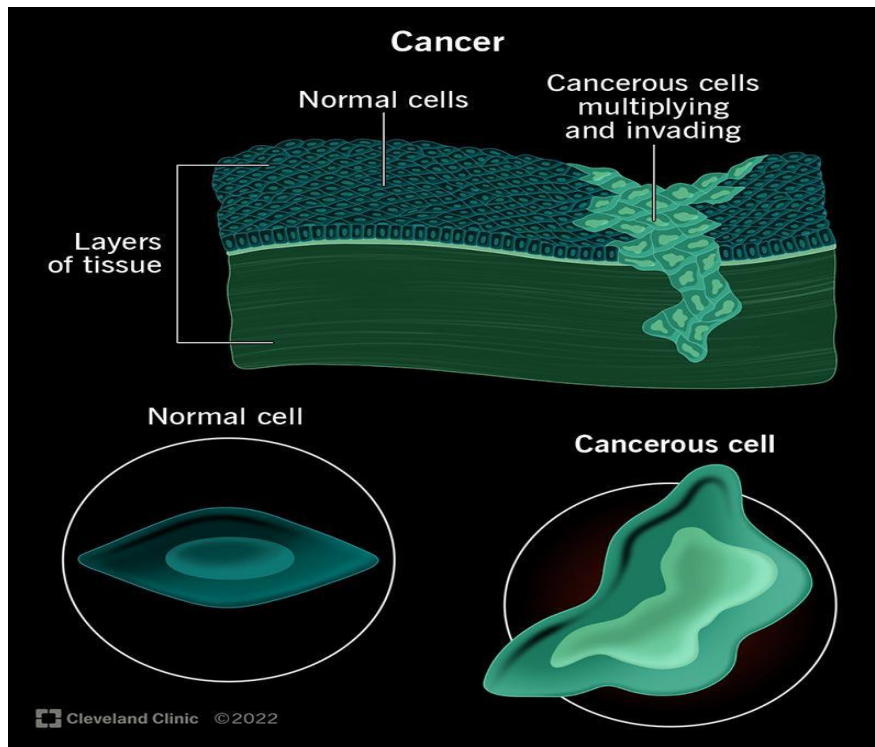


Fig .7 [25]

Symptoms

Cancer is an intricate illness. Cancer can exist for years without showing any symptoms. In other cases, cancer may present with observable symptoms that rapidly worsen. Numerous signs of cancer mimic those of other, less dangerous diseases. Certain symptoms are not indicative of malignancy. If there is a change in your body that lasts longer than two weeks, you should generally consult a healthcare provider. (25)

First line symptoms

- unexplained weight loss.
- Chronic tiredness.
- Persistent pain.
- Fever that occurs mostly at night.
- Skin changes, particularly moles that change shape and size or new moles.
- Bruising or bleeding more easily.
- Lumps or bumps under your skin that don't go away.
- Difficulty breathing.
- Difficulty swallowing

Causes

Cancer is heredity illness. It occurs when genes that control cell activity changes, producing aberrant cells that proliferate and divide until they finally interfere with normal bodily functions. It is estimated by medical research that heredity genetic alteration that uncontrollable account for 5 to 12% of all cancer causes. Cancer most often results from an acquired genetic mutation during our lifetime.(25)

RISK FACTOR FOR AUTOIMMUNE DISEASE

1. Sex

In all, women make up 78% of those with autoimmune diseases .In terms of specific disorders, women make for up to 95% of patients with Sjogren's syndrome and systemic lupus erythematosus (SLE) (2).About 60% more women than men suffer from other illness arthritis. The higher occurrence of autoimmune diseases in females may be due to factors specific to women, such as the extra X chromosome, specific hormonal changes, reproductive function, immunological responses, impact of environmental agents, and organ sensitivity.

2. Genetics

Female: specific variables, including the extra X chromosome, particular hormonal changes, reproductive function, immunological responses, the influence of environmental agents, and organ sensitivity, may account for the increased incidence of autoimmune illnesses in women. Your risk of developing autoimmunity is increased if you have an inherited genetic variant that could affect your immune response. The epigenome, a layer of chemical markers that lies on top of your DNA, can change how that specific gene is expressed. Environmental triggers can activate or deactivate certain regions of the genome through intricate chemical reactions when they interact with the epigenome. Examples of these triggers include toxic substances, infections or other physical traumas, intestinal dysbiosis, and nutritional variables.

3. Obesity

We must acknowledge the connection between obesity and other chronic illnesses like autoimmune disease, as adults in the United States make up 72% of the overweight and obese population, and around 35% of the world's population is overweight or obese. Over 10 autoimmune disorders are linked to excess weight, and additional autoimmune diseases may

also be linked to it. It has been discovered to raise the chance of getting autoimmune diseases such psoriatic and rheumatoid arthritis.

4. Smoking and exposure to toxic agents

It is commonly recognized that smoking cigarettes causes cancer and is not a healthy habit. Researchers are now learning that smoking increases the likelihood of developing diseases other than respiratory ailments. Numerous autoimmune disorders, including multiple sclerosis, rheumatoid arthritis, and systemic lupus erythematosus, have been related to smoking. Thousands of compounds are created when tobacco is burned, some of which are known to be hazardous. Smoke inhalation affects the immune system through a variety of intricate interactions, such as immunological suppression, inflammatory reactions, dysregulation of cytokines (molecules that indicate autoimmunity), and the production of autoantibodies. Autoimmune illnesses such as multiple sclerosis have also been linked to exposure to various poisons such as crystalline silica, air pollution, UV light, or chemical solvents.

5. Infection

An increased risk of developing an autoimmune illness arises from early exposure to specific pathogens. Epstein Barr Virus (EBV) is linked to rheumatoid arthritis, Sjogren's disease, and systemic lupus erythematosus. It typically manifests as a minor sickness in childhood before going dormant. A different type of pathogenic microbe known as Group A Streptococcus is capable of causing autoimmune diseases connected to the heart, joints, and brain, such as rheumatic heart disease and acute rheumatic fever. These viruses use a range of techniques to affect your genetic makeup. To put it briefly, they have the power to activate specific genes that affect the immune system's capacity to distinguish between self and non self, so inducing an autoimmune response. There are a number of connections between the SARS-con 2 virus and autoimmune diseases, although these connections are currently being studied by experts. It has been documented that COVID19 infection can precipitate Guillain Barre syndrome, antiphospholipid syndrome, lupus, and other medical conditions.

6. Certain medications

A lot of people take medications on a regular basis to control their anxiety and depression, lower their blood pressure, or maintain normal cholesterol levels. Furthermore, it is well known that certain medications may have adverse consequences. We're learning that these

adverse effects can occasionally influence immune system function and result in autoimmune reactions. Antibiotics, statins, and some blood pressure drugs can cause drug induced autoimmune diseases such as autoimmune hepatitis or lupus.(27)

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