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Review Article

Biological features involved Pathogenesis, Molecular Immune Responses and Genes Involved for Infectious Diseases

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Abstract

Infectious diseases are caused by transmission of infections from animals either in the form of biting of different tissues of human. Infectious diseases are also caused by organisms such as bacteria, viruses, fungi or parasites and transmission rate high such as rabies, tuberculosis, HIV/AIDS and Ebola viruses. Major histocompatibility complex (MHC) is involved in the immune responses against the pathogenic attack. Natural Killer T cells, lymphocytes, macrophages and interleukins are involved in immune responses. Cytokines releases that causes immune responses by releasing the chemicals. Bacterial infections are those caused by *salmonella* and *E.coli* are most common in modern environment. Fungal growth on skin causes different fungal infections that leads to borne of many skin diseases, such as ringworm and athlete's foot. *Histoplasma capsulatum* affects the lungs in two ways either in the form of acute or chronic inflammation. Tuberculosis (TB) is the most infectious disease widespread caused by *Mycobacterium tuberculosis* that causes lungs and respiratory problems. Different types of genes are involved in immune responses when there is attack of coronavirus to the specific immune cells. Genome editing helpful for editing the specific gene in the microbial cells that causes the inhibition of genes causing infectious diseases.

Keywords: Infections, Disease, Immune responses, genes targets, Coronaviruses.

INTRODUCTION

Infectious diseases are those groups of infectious diseases that are caused by transmission of infections from animals either in the form of biting of different tissues of human [1, 2]. In this way, they are directly involved in transmission of infection from animals to human body. The transferring infections are due to bacteria, viruses, fungi or parasites. Many organisms live in our bodies. They're normally harmless or even helpful while on the other hand, some microorganisms in different tissues of animals producing the toxins that causing the different types diseases [3]. Infectious diseases become the global health issue in the modern era due to large population of newly growth of microorganisms in modern environment. But under certain conditions, some organism may cause disease [4].

Infectious diseases are caused by organisms such as bacteria, viruses, fungi or parasites and transmission rate high from animals to the human through biting such as rabies, high level of respiratory tract infections due to tuberculosis disease, infections in lungs to damaging to lungs, athlete foot due to fungi, HIV/AIDS due to infections caused by HIV family viruses and Ebola viruses. These viruses have dynamic environment to grow in which they can cause the specific disease in order to replicate in the host and sometimes can a serious condition leads to autoimmunity [5, 6].

Table-1: Shows the infectious diseases, causing agent and clinical significance

Infectious Disease Type	Causing Agent	Clinical Significance	Reference
Diphtheria	Bacteria	It causes problems in breathing, heart development, and paralysis.	[35]
Ebola	Viruses	Damages to blood vessels, causing severe bleeding once takes its active form	[36]
Hepatitis	Viruses	It infects the liver cells and causing the severe inflammation in liver cells.	[37]
Coronavirus	Viruses	It causes lungs infections also causes the Sepsis and this has high replicate rate.	[32,33]
HIV	Viruses	It also causes the damage to immune cells also cells of brain cells and causing damage to nervous system.	[27]
Hib	Bacteria	It causes the disruption of brain cells and causing damage to nervous system.	[38]
Blastomycosis	Fungi	It infects the body by difficult breathing, chest pain also the sweating under certain conditions once grow in favorable environment.	[27]
Histoplasmosis	Fungi	It causes the severe infections in lungs tissues.	[23-25]
C. gattii Infection	Fungi	It causes also tight breathing by causing the severe infections in lungs tissues.	[28]

Genes Involvement and Inflammatory Responses

Different types of gene receptors are linked to the infectious disease such as human leukocyte antigen and multiple histocompatibility loci. Major histocompatibility complex (MHC), is the group of genes that involved in the immune responses against the pathogenic attack. Cytokines releases that causes immune responses by releasing the chemicals [7]. They are releasing receptor biding chemicals that show strong biding to the targeted tissues where pathogens form colonization. MHC class I molecules bind to peptides produced by the intracellular degradation of viral proteins and display them on the cell surface for recognition by CD8+ T lymphocytes [8].

Infections caused by Different Bacterial Strains

Bacterial infections are difficult to treat due to antibiotic resistance against different types of drugs. Bacterial infections are those caused by *salmonella* and *E.coli* is most common in modern environment. These one-cell organisms are responsible for illnesses such as strep throat, urinary tract infections and tuberculosis. There is need to design such synthetics drugs that can contribute to stop the infection caused by bacteria particularly in those environments where infections rate is too high such as hospital, wastage garbage's and food items[9-11].

Infections caused by Infectious Viruses

Zoonotic diseases are also transmitted through viruses that have high replicate rate as compared to other organisms. Even smaller than bacteria, viruses cause a multitude of diseases ranging from the common cold to HIV/AIDS, Ebola, and COVID-19. Viruses invade living, normal cells and use those cells to multiply and produce other viruses like themselves. They attempted to attach surfaces of living organisms' particularly human by binding to receptors and invade the cells by using their metabolic machinery. They also invade to different tissues of human body that are involved in synthesis of protein for survival. Amongst of all infectious zoonotic disease, COVID-19 is the most lethal disease that strains difficult to control as compared to the other different viral strains[12-14].

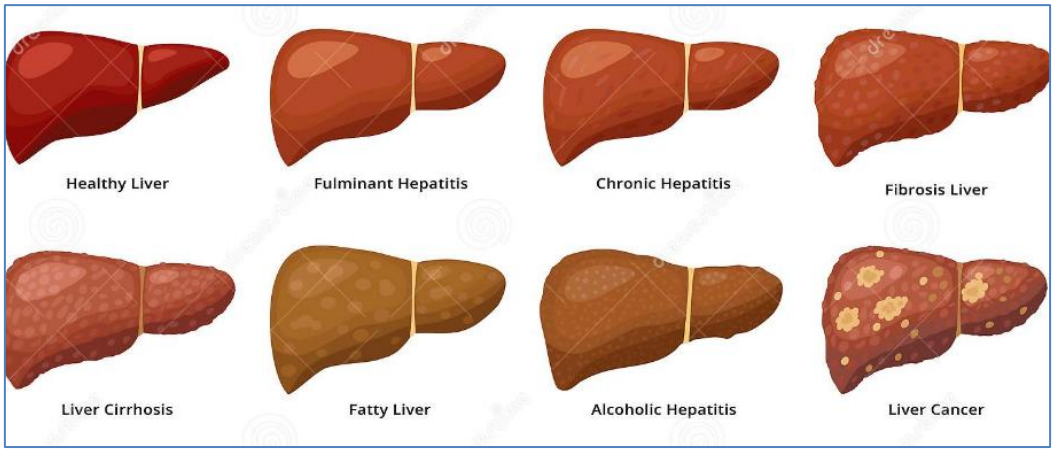

Fig-1: Shows the different types of liver cancer with metabolic profile

Diseases caused by Fungi and other parasites

Fungi also cause lots of diseases among the animals and human as fungal growth is difficult to control under favorable conditions of temperature and pressure. Fungal growth on skin causes different fungal infections that lead to borne of many skin diseases, such as ringworm and athlete's foot. Other types of fungi can infect your lungs or nervous system by attacking on cells of nuroganglia. It resulted the poor functioning of brain cells and ultimately leads to Alzheimer and Parkinson disorders. Many other infections that transmitted from animals to human also caused by different types of parasites. Malaria is caused by a tiny parasite that is transmitted by a mosquito bite. Other parasites may be transmitted to humans from animal feces [14-17].

Various Immune Responses in Infectious Diseases

There are different factors affecting the immune responses against the infectious diseases due to attack on immune cells and anyone can get an infectious disease with comprised immune system. Natural Killer T cells, lymphocytes, macrophages and interleukins are involved in immune responses. Infectious agent when enters into the body, shows penetration into the host cells by damaging their membranes. People with a compromised immune system, an immune system that doesn't work at full strength have greater risk for certain types of infections. Cancers such as breast, liver carcinoma, pancreatic cancer, digestive tract infections, ovarian cancer, bile duct infections and respiratory tract infections leads to increase the risk deaths among those with weak immune system. People with suppressed immune systems, such as those going through cancer treatment or who have recently had an organ transplant [18-22]

***Histoplasmosis* as Infectious Disease**

Different infections caused by fungi causes the increase risk problems of global health. *Aspergillus* primarily affects the lungs by damaging the inflating tissues of lungs due to which air cannot properly enter into the lungs. It resulted the poor growth of pleura that ultimately leads to symptoms of asthma, coughing and bronchi infections. *Histoplasma capsulatum* is a dimorphic fungus that remains in a mycelial form at ambient temperatures and grows as yeast at body temperature in mammals [23, 24].

Histoplasma capsulatum afftects the lungs in two ways either in the form of acute or chronic inflammation. However, chronic infections caused by *Histoplasma capsulatum* causes disruption of bronchi and causing inflammatory responses that activate the immune system of the body through cellular and molecular mechanisms. Infection causes histoplasmosis. There is need to design antifungal drugs that can binds to the targeted cells of the *Histoplasma capsulatum*. In this way, competitive mechanisms can be developed for binding to the lungs cells through histoplasmosis and antifungal drugs. There is changing environment that leads to increase the growth of fungal infections [25, 26].

***Mycobacterium tuberculosis* as Infectious Disease**

Tuberculosis (TB) is the most infectious disease widespread caused by *Mycobacterium tuberculosis* that causes lungs and respiratory problems. Sometimes, chronic infections caused by *Mycobacterium tuberculosis* also damages to other organs of the body [27]. Different methods are used for measuring the concentrations of *Mycobacterium tuberculosis* but due to wide tramping routes, anti-TB drugs are employed for therapeutic purposes. While on the other hand, no effective treatment available yet. *M xenopi* colonization occurs from ingestion or inhalation of, or cutaneous exposure to, organisms in water, soil, or airborne particles. Colonization of hospital water systems is associated with infection, disease, and nosocomial isolation. There is need to characterize the *Mycobacterium tuberculosis* at molecular level to target them in order to find out the drug immune responses for clinical trials [28, 29].

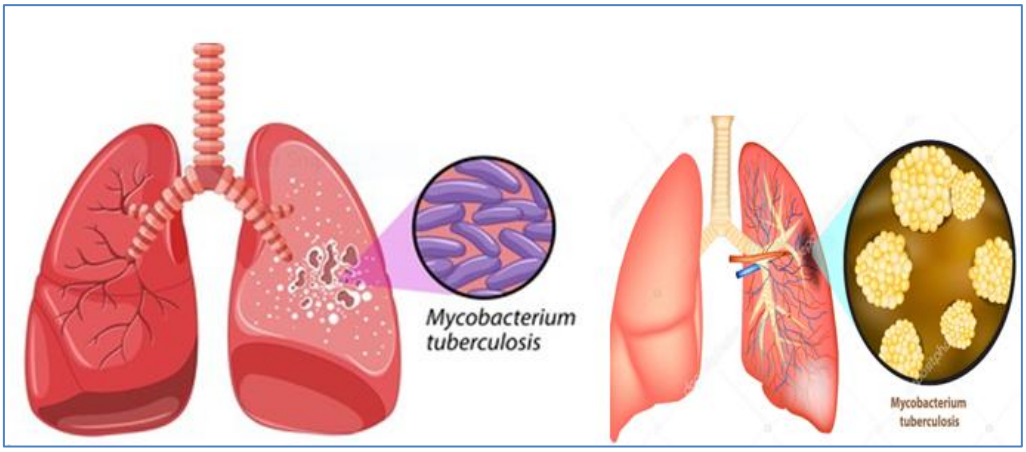

Fig-2: Shows the left side with normal lung and right shows the *M.tuberculosis*

Coronaviruses as Infectious Disease

Coronaviruses typically affects the respiratory tract, but their effects can extend well beyond the respiratory system. Different types of genes are involved in immune responses when there is attack of coronavirus to the specific immune cells. Group of genes family are contributed in immune responses. These are Interferon alpha/beta receptor 2 precursors-IFNAR2, receptor tyrosine-protein kinase-TYK2, Dipeptidyl Peptidase IV-Related Protein-2-DPRP2. Many of these sequencing techniques are used for checking the expression of genes. The expression analysis of these genes helpful for detection of coronaviruses in order to control the progression of disease and these genes can be sued as biomarkers for molecular therapeutic diagnostics purposes [30-32]. Many COVID-19 complications may be caused by a condition known as cytokine release syndrome or a cytokine storm. This type of protein causes the inflammatory responses in different tissues also kills the tissues of the body if increased in their concentration. Different kinds of vaccine although available in order to control the incidence rate of coronavirus. Due to rapid replication in the particular host and attacking mood of this virus, this virus has different strains due to which it prevalence high as compared to the other kinds of viruses [33-38].

CONCLUSION

Although, risk of infectious diseases increases due to resistance of microbes against a variety of drugs that leads to become a global health issue. There is need to design such kinds of drugs that can controlled the growth of changing environment so that microbes can also be used as biological tools for biological processes. Genome editing helpful for editing the specific gene in the microbial cells that causes the inhibition of genes causing infectious diseases.

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