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REVIEW ARTICLE

Viral Infection Prevention and Control Precautions

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ABSTRACT

This review article mainly focused on the prevention and control precautions of viral disease which continue to cause considerable the morbidity and the mortality around the world. Prevention included: Primary preventions such as vaccination, pre- and post-exposure prophylaxis, reduction of viral exposure, hygiene/disinfection, screening of blood products, raising awareness/counseling and secondary prevention such as treatment of infected people, identification and counseling of infected people, and diagnosis of infected people. In control and precautions included avoiding sexual contact with HIV-infected individuals, avoiding drug abuse, screening of blood before transfusion, using condoms during sexual contact, avoiding contaminated syringe and needles, wash hands as needed, and maintain personal hygiene.

Keywords: Control and precaution of viral infection, prevention of viral infection, viral infection

INTRODUCTION

Viral disease is extremely widespread infections caused by viruses, a type of microorganism. There are many types of viruses that cause a wide variety of viral disease. The most common type of viral disease is the common cold, which is caused by a viral infection of the upper respiratory and throat. Other common viral diseases include.[1]

VIRAL DISEASES[2,3]

In some cases, viral disease can lead to serious, possibly life-threatening complication, such as dehydration, bacterial pneumonia, and other secondary bacterial infections.

Viral diseases are contagious and spread from person to person when a virus enters the body and begins to multiply. Common ways that viruses spread from person to person include:

- Breathing in air-borne droplets contaminated with a virus
- Eating food or drinking water contaminated with a virus
- Having sexual contact with a person who is infected with a sexually transmitted virus
- Indirect transmission from person to person by a virus host, such as a mosquito, tick, or field mouse
- Touching surfaces or body fluids contaminated with a virus.

HISTORY[4]

The history of viruses describes the influence of viruses and viral infections on human history [Table 1].

GENERAL CHARACTERISTICS OF VIRUSES

Viruses are acellular organisms, that is, they do not possess a cellular structure. They are non-living (inert) outside the living organism (host) but living inside the living organism. They are obligate intracellular parasites which are smaller in size than bacteria as they can easily pass through bacterial filters. They can replicate themselves only inside the living organism (host) eventually controlling

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the host machinery and killing host cells. They cause diseases in their specific host.[6-8]

STRUCTURE OF VIRUSES[9]

Viruses are small obligate intracellular parasites, which by definition contain either a RNA or DNA genome surrounded by a protective, virus-coded protein coat [Figure 1].

Some virus families have an additional covering, called the envelope, which is usually derived in part from modified host cell membranes. Viral envelopes consist of a lipid bilayer that closely surrounds a shell of virus-encoded membrane-associated proteins. Virus envelopes can be considered an additional protective coat. These viruses often have proteins, called matrix proteins that function to connect the envelope to the capsid inside. A virus that lacks an envelope is known as a non-enveloped or naked virus.[11-13]

CHEMICAL COMPOSITION OF VIRUS[14]

- Nucleic acid
- Protein
- Lipid
- Carbohydrate.

VIRUS REPLICATION

Attachment

The binding of the virus to the host cell: This interaction is specific: The virus contains a virus attachment protein that adsorbs to a cell surface receptor on the cell.[15]

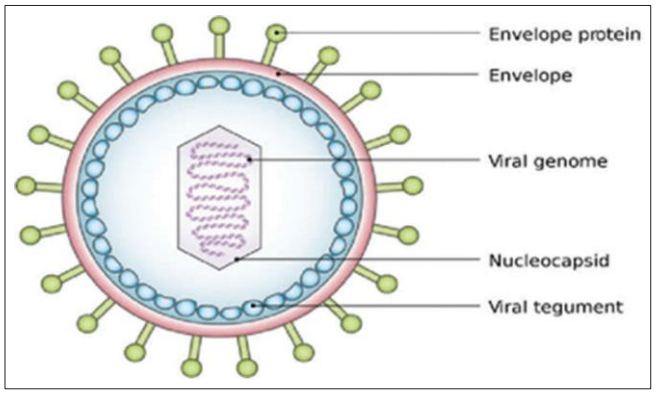

Figure 1: Basic Virus structure[10]

Penetration

Penetration refers to the crossing of the plasma membrane by the virus. In contrast to virus attachment, penetration requires energy, although this is contributed by the host cell, not the virus.[16]

Uncoating

The removal of a virus envelope during membrane fusion is the initial stage of the uncoating process for enveloped viruses.[17]

Replication

In the same way that our DNA encodes the information to manufacture our proteins, a virus's genome acts as the instructions for the synthesis of virus proteins.[18,19] General replication strategies of virus categorizes into seven classes based on their type of genome;[20]

i. Double-standard DNA viruses
ii. Single-standard DNA viruses
iii. Double-standard RNA viruses
iv. Positive-sense RNA viruses
v. Negative-sense RNA viruses
vi. RNA and DNA viruses that reserve transcribe.

Assembly

During assembly, the basic structure of the virus particle is formed as all the components necessary for the formation of the mature virion come together at a particular site in the cell.[21]

Mutation

Maturation is the stage of the replication cycle at which virus particles become infectious.[22]

Release

The final step in the virus replication cycle is release of the virion into the extracellular environment, where it can continue the cycle of infection with new cells [Figure 2].[23]

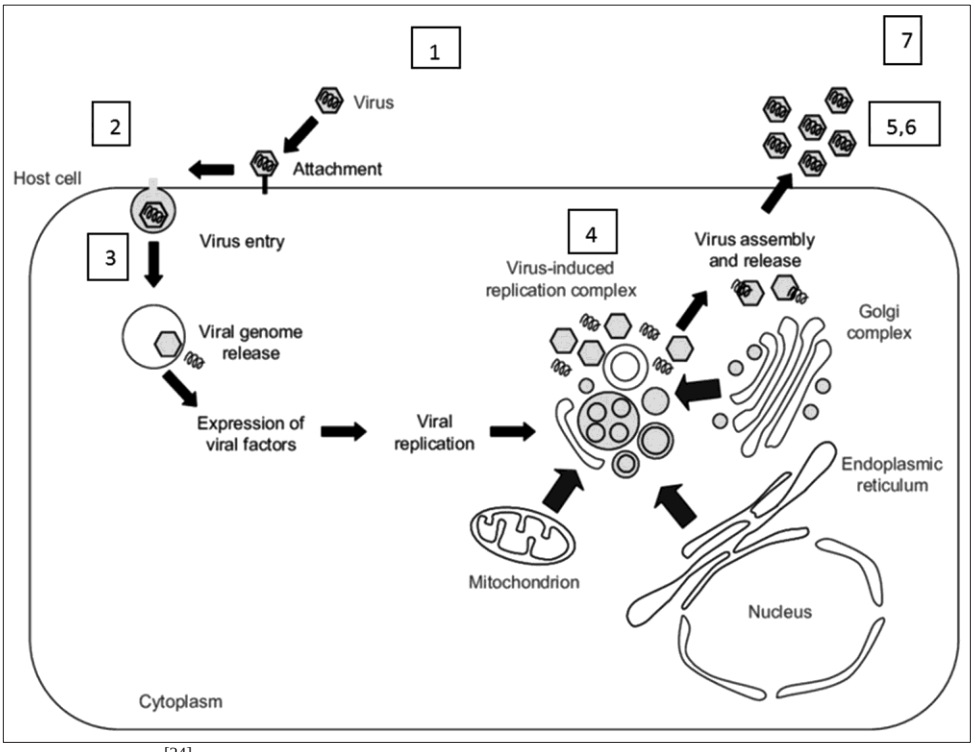

Figure 2: Virus replication cycle[24]

Type of Viral Infection their Prevention and Control Precautions

Influenza virus[25-27]

Introduction

Influenza (mostly referred to as "flu") is a contagious viral infection caused primarily by the influenza virus A, B, and C. It affects mainly the upper respiratory organs (i.e., the nose, throat, bronchi, and infrequently, lungs) but other organs such as the heart, brain, and muscles can be involved.

Prevention

Some high risk patients may receive antiviral medications to prevent flu after being exposed.

- Recombinant influenza vaccine
- Live, attenuated influenza vaccine
- Use Public Service Announcements to educate people
- Prepare plans for schools, worksite, and hospitals for outbreak.

Control and precaution

a. Do not touch your face with unwashed hands, it is the easiest way for germs to enter your body
b. To cover your mouth and nose
c. To eat health and balanced meals to strength your immune system
d. Use a surgical face mask or a textile mask to protect against droplets
e. To avoid touching surfaces with bare hands or shaking hands with anyone in the facility.

Viral encephalitis[28,29]

Introduction

Viral encephalitis is an inflammation of the brain parenchyma caused by a virus. It is the most common type of encephalitis and often coexists with viral meningitis. Viruses invade the host outside the central nervous system (CNS) and then reach the spinal cord and brain.

Prevention

The treatment of Herpes simplex virus (HSV) encephalitis, started early Acyclovir, has been shown to significantly decrease mortality and morbidity rate. The recommended dose is 10 mg/kg intravenous every 8 h for 14–21 days with possible adjunctive corticosteroid in immunocompetent patients, which is recommended for varicella-zoster virus.

Table 1: Some milestones in the history of virology[5]

Date	Discoverer	Discovery
1796	E. Jenner	Application of cowpox virus for vaccination against smallpox
1892	D. Ivanovsky, M. Beijerinck	Ultrafiltration of tobacco mosaic virus
1898	F. Loeffler, P. Frosch	Ultrafiltration of foot-and-mouth disease virus-clear proof of virus etiology of disease-discovery of the first virus
1903	M. Remlinger, Riffat-Bay, A. di Vestea	Discovery of rabies virus
1907	P. Ashburn, C. Craig	Discovery of dengue viruses
1909	K. Landsteiner, E. Popper	Discovery of polioviruses
1967	B. Blumberg, H. Alter, A. Prince	Discovery of Australia antigen and its link to hepatitis B
2001	B. van den Hoogen, A. Osterhaus, colleagues	Discovery of human metapneumovirus
2003	C. Urbani, J. Peiris, S. Lai, L. Poon, G. Drosten, K. Stöhr, A. Osterhaus, T. Ksiazek, D. Erdman, C. Goldsmith, S. Zaki, J. DeRisi, others	Discovery of SARS coronavirus
2010	W. Plowright and the FAO Global Rinderpest Eradication Program	Global eradication of rinderpest
2011	B. Hoffmann, M. Beer, T. Mettenleiter, colleagues	Discovery of Schmallenberg virus
2012	A.M. Zaki, R. Fouchier, W.I. Lipkin	Discovery of MERS coronavirus

Control and precaution

a. Practice good hygiene like washing hands frequently
b. To avoid contact with infected person
c. To follow infection control procedures
d. Get rid of contaminated water and food and their sources outside your home
e. To teach children for good personal hygiene and habits**.**

***Viral hepatitis*[30]**

Introduction

The term viral hepatitis is used to describe infection of the liver caused by Hepatotropic viruses. At present, there are five main strains of the hepatitis virus, referred to as types A, B, C, D, and E.

Prevention

Primary prevention

- Advocacy and raising awareness of all types of viral hepatitis infections help reduce transmission in the community
- Safe and effective vaccines are widely available for the prevention of HAV and HBV infections
- Safe food and water provide protection against HAV and HEV infections.

Secondary and tertiary prevention

- Avoiding certain drugs and tobacco that are known to be toxic to the liver
- Antiviral agents against HBV and HCV exist. Currently, three antiretrovirals (TDF, 3TC, and FTC) are effective for the treatment of both HIV and HBV.

Control and precautions

a. To avoid contact with infected person
b. To follow infection control procedures
c. Practice good hygiene like washing hands frequently.

***Dengue hemorrhagic fever*[31]**

Introduction

The word dengue is derived from African word "*denga*" meaning fever with hemorrhages. Dengue is caused by virus transmitted by bites of mosquito *Aedes aegypti*. Dengue is an acute febrile disease triggered by an infection with dengue virus.

Prevention

- Take acetaminophen to control fever and relieve pain
- Drink plenty of fluids to stay hydrated. Drink water or drinks with added electrolytes
- Avoid non-steroidal anti-inflammatory drugs like ibuprofen and aspirin.

Control and precautions

a. Mosquito bite
b. Wear long-sleeved shirts and pants

c. Use insect repellent (containing DEET, Picaridin, or IR3535)
d. Use an indoor insect fogger or indoor insect spray to kill mosquitoes
e. Keep windows and doors shut.

Rabies virus[32]

Introduction

Rabies is a zoonotic viral infectious disease which means spread by animals to human. In humans, affected or rabid animals are the source to transmit rabies virus hence humans are affected by this infection. Rabies virus is the prototype virus.

Prevention and control

a. It required enhanced surveillance
b. Accurate and timely diagnosis with proper reporting
c. Pre-exposure increased rate of vaccination in animals against rabies
d. Preventive immunization is recommended by the WHO for all the staffs involved in handling of infected material
e. Three injections are included in the immunization protocol at day 0, 7, and 28. Booster vaccination is recommended for every year
f. Rabies virus strains like SAG 2, SAD Bern, and SAD B19 were used for oral immunization in wildlife for rabies control programs
g. Post-exposure prophylaxis (PEP) is accompanied by anti-rabies immunoglobulin injection of either human.

Smallpox[33-35]

Introduction

Smallpox is caused by infection with variola major, a virus of the family Poxviridae. Smallpox, also called variola major, acute infectious disease that begins with a high fever, headache, and back pain and then proceeds to an eruption on the skin that leaves the face and limbs covered with cratered pockmarks, or pox.

Prevention

- Smallpox vaccine – Smallpox can be prevented by smallpox vaccines, also called vaccinia virus vaccines.
- 1. In July 2018, the FDA approved tecovirimat (TPOXX) for treatment of smallpox.
- 2. In June 2021, the FDA approved brincidofovir (TEMBEXA) for treatment of smallpox.

Control and precautions

a. Personal protective equipment like PPE kit
b. Leaving the infected area
c. Isolation and restriction
d. Hospital isolation
e. To teach children for good personal hygiene and habits
f. To avoid exposure to virus that causing the disease
g. To follow infection control procedures.

Herpes simplex[36,37]

Introduction

Herpes simplex, infection of either the skin or the genitalia caused by either of two strains of herpes simplex virus. HSV-1 is transmitted orally and is responsible for cold sores and fever blisters, typically occurring around the mouth, whereas HSV-2 is transmitted sexually and is the main cause of the condition known as genital herpes.

Prevention

- Taking pain relief medication, such as acetaminophen or ibuprofen
- Antiviral medication, such as Acyclovir,

Control and precautions

- Using barrier protection, such as condoms, when having sex
- Avoiding sex while symptoms are present
- Washing the hands thoroughly, especially after touching the affected area, during an outbreak.

Poliovirus[38-40]

Introduction

Polio is an infectious disease, contracted predominantly by children that can lead to the permanent paralysis of various body parts and can ultimately cause death by immobilizing the patient's breathing muscles.

Prevention

It is highly effective in producing immunity to poliovirus and protection from paralytic poliomyelitis since it prevents wild poliovirus from reaching the CNS in recipients. At least 99% of recipients are immune after three doses.

Control and precautions

a. Emphasize cleaning of high-touch surfaces (e.g., doorknobs, handrails, telephones, keys, computer keyboards)
b. Promote awareness of the risk of infectious disease spread in the correctional environment
c. Medical isolation or Quarantine cell requires who have epidemiologic risk factors for polio virus infection
d. It required enhanced surveillance
e. Awareness campaigns through mass media outlets and workshops.

CONCLUSION

There is a various infections or disease including major to minor cause by different type of viruses influenza virus, viral encephalitis, viral hepatitis, dengue hemorrhagic fever, rabies virus, smallpox, herpes simplex, and poliovirus. There is no one solution for prevention and precaution of these different virus infections. Depending on virus or their viral disease there is various types of prevention and precaution, control of viral infection. Prevention included: Primary prevention such as vaccination, pre- and post-exposure prophylaxis, reduction of viral exposure, hygiene/ disinfection, screening of blood products, and raising awareness and secondary prevention such as treatment of infected people, identification of infected people, and diagnosis of infected people. In control and precautions included avoiding sexual contact with HIV-infected individuals, avoiding drug abuse, screening of blood before transfusion, using condoms during sexual contact, avoiding contaminated syringe and needles, washing hands as needed, and maintaining personal hygiene.

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