DNA enveloped viruses:-

1- **POXVIRUSES**

The poxvirus family includes three viruses of medical importance: smallpox virus, vaccinia virus, and molluscum contagiosum virus. Poxviruses are the largest and most complex viruses.

SMALL POX VIRUS:-

Disease

Smallpox virus, also called variola virus, is the agent of smallpox, the only disease that has been eradicated from the face of the Earth. **Eradication** is due to the vaccine. There is concern regarding the use of smallpox virus as an agent of bioterrorism. Poxviruses of animal origin, such as cowpox and monkey pox.

Important Properties

Poxviruses are brick-shaped particles containing linear double-stranded DNA, a disk-shaped core within a double membrane, and a lipoprotein envelope. The virion contains a DNA-dependent RNA polymerase. This enzyme is required because the virus replicates in the cytoplasm and does not have access to the cellular RNA polymerase, which is located in the nucleus.

Smallpox virus has a single, stable serotype, which is the key to the success of the vaccine. If the antigenicity varied as it does in influenza virus, eradication would not have succeeded. Smallpox virus infects only humans; there is no animal reservoir.

Transmission & Epidemiology

Smallpox virus is transmitted via **respiratory aerosol or by direct contact** with virus either in **the skin lesions** or on **fomites** such as bedding.

Pathogenesis & Immunity

Smallpox begins when the virus infects the upper respiratory tract and local lymph nodes and then enters the blood (primary viremia). Internal organs are infected; then the virus reenters the blood (secondary viremia) and spreads to the skin. These events occur during the incubation period, when the patient is still well. The rash is the result of virus replication in the skin, followed by damage caused by cytotoxic T cells attacking virus-infected cells.

Immunity following smallpox disease is lifelong; immunity following vaccination lasts about 10 years.

Clinical Findings

After an incubation period of 7 to 14 days, there is a sudden onset of prodromal symptoms such as fever and malaise. This is followed by the rash, which is worse on the face and extremities than on the trunk (i.e., it has a centrifugal distribution). The rash evolves through stages from macules to papules, vesicles, pustules, and, finally, crusts in 2 to 3 weeks.

Laboratory Diagnosis

In the past when the disease occurred, the diagnosis was made either by growing the virus in cell culture or chick embryos or by detecting viral antigens in vesicular fluid by immunofluorescence.

Prevention

The disease was eradicated by global use of the **vaccine,** which contains live, attenuated **vaccinia virus**. The success of the vaccine is dependent on five critical factors: (1) smallpox virus has a single, stable serotype; (2) there is no animal reservoir, and humans are the only hosts; (3) the antibody response is prompt, and therefore exposed persons can be protected; (4) the disease is easily recognized clinically, and therefore exposed persons can be immunized promptly; and (5) there is no carrier state or subclinical infection.

The vaccine is inoculated intradermally, where virus replication occurs. The formation of a vesicle is indicative of a "take" (success).

2- <u>Hepadnaviruses</u>:-

Hepatitis:-

It is inflammation of the liver tissue. Some people with hepatitis have no symptoms, whereas others develop yellow discoloration of the skin and whites of the eyes (jaundice), vomiting, tiredness, abdominal pain, and diarrhea.

Hepatitis is **acute** if it resolves within six months, and **chronic** if it lasts longer than six months. Acute hepatitis can resolve on its own, progress to chronic hepatitis, or (rarely) result in acute liver failure. Chronic hepatitis may progress to scarring of the liver (cirrhosis), liver failure, and liver cancer.

Hepatitis is most commonly caused by the viruses hepatitis A, B, C, D, and E. Other causes include heavy alcohol use, certain medications, toxins,

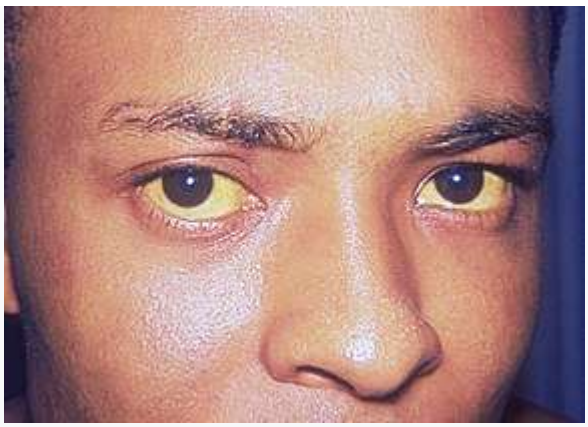
Hepatitis A and E are mainly spread by contaminated food and water.

Hepatitis B is mainly sexually transmitted, but may also be passed from mother to baby during pregnancy or childbirth and spread through infected blood.

Hepatitis C is commonly spread through infected blood such as may occur during needle sharing by intravenous drug users.

Hepatitis D can only infect people already infected with hepatitis B.

Hepatitis A, B, and D are preventable with immunization. Medications may be used to treat chronic viral hepatitis. Antiviral medications are recommended in all with chronic hepatitis C, except those with conditions that limit their life expectancy.



Jaundiced eyes

Signs and Symptoms

Hepatitis has a broad spectrum of presentations that range from a complete lack of symptoms to severe liver failure. The acute form of hepatitis, generally caused by viral infection, is characterized by constitutional symptoms that are typically self-limiting.

Chronic hepatitis presents similarly, but can manifest signs and symptoms specific to liver dysfunction with long-standing inflammation and damage to the organ.

Acute hepatitis:-

Acute viral hepatitis follows three distinct phases:

1. The initial prodromal phase (preceding symptoms) involves non-specific and flu-like symptoms common to many acute viral infections. These include fatigue, nausea, vomiting, poor appetite, joint pain, and headaches. Fever, when present, is most common in cases of hepatitis A and E. Late in this phase, people can experience liver-specific symptoms, including choluria (dark urine) and clay-colored stools.
2. Yellowing of the skin and whites of the eyes follow the prodrome after about 1–2 weeks and can last for up to 4 weeks. The non-specific symptoms seen in the prodromal typically resolve by this time, but people will develop an enlarged liver and right upper abdominal pain or discomfort.
3. All cases of hepatitis A and E are expected to fully resolve after 1–2 months. Most hepatitis B cases are also self-limiting and will resolve in 3–4 months. Few cases of hepatitis C will resolve completely.

Massive hepatic cell death

It is a rare and life-threatening complication of acute hepatitis that can occur in cases of hepatitis B, D, and E, in addition to drug-induced and autoimmune hepatitis. The complication more frequently occurs in instances of hepatitis B and D co-infection at a rate of 2–20% and in pregnant women with hepatitis E at rate of 15–20% of cases. In addition

to the signs of acute hepatitis, people can also demonstrate signs of coagulopathy (abnormal coagulation studies with easy bruising and bleeding) and encephalopathy (confusion, disorientation, and sleepiness). Mortality due to fulminant hepatitis is typically the result of various complications including cerebral edema, gastrointestinal bleeding, sepsis, respiratory failure, or kidney failure.

Chronic hepatitis

Acute cases of hepatitis are seen to be resolved well within a six-month period. When hepatitis is continued for more than six months it is termed chronic hepatitis. Chronic hepatitis is often asymptomatic early in its course and is detected only by liver laboratory studies for screening purposes or to evaluate non-specific symptoms. As the inflammation progresses, patients can develop constitutional symptoms similar to acute hepatitis, including fatigue, nausea, vomiting, poor appetite, and joint pain.

Jaundice can occur as well, but much later in the disease process and is typically a sign of advanced disease. Chronic hepatitis interferes with hormonal functions of the liver which can result in acne, hirsutism (abnormal hair growth), and amenorrhea (lack of menstrual period) in women. Extensive damage and scarring of the liver over time defines cirrhosis, weight loss and peripheral edema (leg swelling). Cirrhosis can lead to other life-threatening complications such as hepatic encephalopathy, esophageal varices, hepatorenal syndrome, and liver cancer.

Causes of hepatitis can be divided into the following major categories: infectious, metabolic, ischemic, autoimmune, genetic, and other.

Infectious agents include viruses, bacteria, and parasites. Metabolic causes include prescription medications, toxins (most notably alcohol), and non-alcoholic fatty liver disease. Autoimmune and genetic causes of hepatitis involve genetic predispositions and tend to affect characteristic populations.

Transmition:-

Hepatitis A and hepatitis E behave similarly: they are both transmitted by the fecal–oral route, are more common in developing countries, and are self-limiting illnesses that do not lead to chronic hepatitis.

Hepatitis B, hepatitis C, and hepatitis D are transmitted when blood or mucous membranes are exposed to infected blood and body fluids, such as semen and vaginal secretions. Viral particles have also been found in saliva and breastmilk. However, kissing, sharing utensils, and breastfeeding do not lead to transmission unless these fluids are introduced into open sores or cuts.

Hepatitis B and C can present either acutely or chronically. Hepatitis D is a defective virus that requires hepatitis B to replicate and is only found with hepatitis B co-infection. In adults, hepatitis B infection is most commonly self-limiting, with less than 5% progressing to chronic state, and 20 to 30% of those chronically infected developing cirrhosis or liver cancer.

Diagnosis of Hepatitis:-

Diagnosis of hepatitis is made on the basis of some or all of the following: a person's signs and symptoms, medical history including sexual and substance use history, blood tests, imaging, and liver biopsy.

In general, for viral hepatitis and other acute causes of hepatitis, the person's blood tests and clinical picture are sufficient for diagnosis. For other causes of hepatitis, especially chronic causes, blood tests may not be useful. In this case, liver biopsy is the gold standard for establishing the diagnosis: histopathologic analysis is able to reveal the precise extent and pattern of inflammation and fibrosis. However, liver biopsy is typically not the initial diagnostic test because it is invasive and is associated with a small but significant risk of bleeding that is increased in people with liver injury and cirrhosis.

Blood testing includes liver enzymes, serology (i.e. for autoantibodies), nucleic acid testing (i.e. for hepatitis virus DNA/RNA), blood chemistry, and complete blood count.

IgM antibodies are found in the blood. In late infection and after recovery, IgG antibodies are present and remain in the body for up to years. Therefore, when a patient is positive for IgG antibody but negative for IgM antibody, he is considered immune from the virus via either prior infection and recovery or prior vaccination.

In the case of hepatitis B, blood tests exist for multiple virus antigens (which are different components of the virion particle) and antibodies. The combination of antigen and antibody positivity can provide information about the stage of infection (acute or chronic), the degree of viral replication, and the infectivity of the virus.

Vaccines

Hepatitis A

The CDC recommends the hepatitis A vaccine for all children beginning at age one, as well as for those who have not been previously immunized and are at high risk for contracting the disease.

For children 12 months of age or older, the vaccination is given as a shot into the muscle in two doses 6–18 months apart and should be started before the age 24 months. The dosing is slightly different for adults depending on the type of the vaccine. If the vaccine is for hepatitis A only, two doses are given 6–18 months apart depending on the manufacturer. If the vaccine is combined hepatitis A and hepatitis B, up to 4 doses may be required.

Hepatitis B

The routine vaccination of all children under the age of 19 with the hepatitis B vaccine. They also recommend it for those who desire it or are at high risk.

Routine vaccination for hepatitis B starts with the first dose administered as a shot into the muscle before the newborn is discharged from the hospital. An additional two doses should be administered before the child is 18 months.

For babies born to a mother with hepatitis B surface antigen positivity, the first dose is unique – in addition to the vaccine, the hepatitis immune globulin should also be administered, both within 12 hours of birth. These newborns should also be regularly tested for infection for at least the first year of life. There is also a combination formulation that includes both hepatitis A and B vaccines.

The treatment of hepatitis varies according to the type, whether it is acute or chronic, and the severity of the disease.

- Activity - Many people with hepatitis prefer bed rest, though it is not necessary to avoid all physical activity while recovering.
- Diet -A high-calorie diet is recommended. Many people develop nausea and cannot tolerate food later in the day, so the bulk of intake may be concentrated in the earlier part of the day. In the acute phase of the disease, intravenous feeding may be needed if patients cannot tolerate food and have poor oral intake subsequent to nausea and vomiting.
- Drugs - People with hepatitis should avoid taking drugs metabolized by the liver. Glucocorticoids are not recommended as a treatment option for acute viral hepatitis and may even cause harm, such as development of chronic hepatitis.

Once it is acquired, persistence of the hepatitis C virus is the rule, resulting in chronic hepatitis C. The goal of treatment is prevention of hepatocellular carcinoma (HCC).

The best way to reduce the long-term risk of HCC is to achieve sustained virological response (SVR). SVR is defined as an undetectable viral load at 12 weeks after treatment completion and indicates a cure. Currently available treatments include indirect and direct acting antiviral drugs. The indirect acting antivirals include pegylated interferon (PEG IFN) and ribavirin (RBV), which in combination have historically been the basis of therapy for HCV. Duration of and response to these treatments varies based on genotype. These agents are poorly tolerated but are still used in some resource-poor areas.

Hepatitis D is difficult to treat, and effective treatments are lacking. Interferon alpha has proven effective at inhibiting viral activity but only on a temporary basis.

Hepatitis E virus Similar to hepatitis A, treatment of hepatitis E is supportive and includes rest and ensuring adequate nutrition and hydration. Hospitalization may be required for particularly severe cases or for pregnant women.

- **DNA Non enveloped viruses**

1- Adenoviruses (members of the family ***Adenoviridae***) are medium-sized (90–100 nm), nonenveloped viruses with an icosahedral nucleocapsid containing a double stranded DNA genome. Their name derives from their initial isolation from human adenoids in 1953.

They have a broad range of vertebrate hosts; in humans, more than 50 distinct adenoviral serotypes have been found to cause a wide range of illnesses, from mild respiratory infections in young children (**known as the common cold**) to life-threatening multi-organ disease in people with a weakened immune system.

Structure:-

Adenoviruses represent the largest known nonenveloped viruses. They are able to be transported through the endosome (i.e., envelope fusion is not necessary). The virion also has a unique "spike" or fiber associated with each penton base of the capsid . that aids in attachment to the host cell via the receptor on the surface of the host cell.

Adenovirus Genome:-

The adenovirus genome is linear, and are able to replicate in the nucleus of vertebrate cells using the host's replication machinery non-segmented double-stranded (ds) DNA that is between 26 and 48 Kbp. This allows the virus to theoretically carry 22 to 40 genes. it is still a very simple virus and is heavily reliant on the host cell for survival and replication.

Infections:-

Most infections with adenovirus result in infections of the upper respiratory tract. Adenovirus infections often present as conjunctivitis, tonsillitis (which may look exactly like strep throat and cannot be distinguished from strep except by throat culture), an ear infection, or croup. Adenoviruses types 40 and 41 can also cause gastroenteritis. A combination of conjunctivitis and tonsillitis is particularly common with adenovirus infections.

Some children (especially the youngest) can develop adenovirus bronchiolitis or pneumonia, both of which can be severe. In babies, adenoviruses can also cause coughing fits that look almost exactly like whooping cough. Adenoviruses can also cause viral meningitis or encephalitis. Rarely, adenovirus can cause hemorrhagic cystitis (inflammation of the urinary bladder—a form of urinary tract infection—with blood in the urine).

Most people recover from adenovirus infections by themselves, but people with immunodeficiency sometimes die of adenovirus infections, and—rarely—even previously healthy people can die of these infections. This may be because sometimes adenoviral infection can lead to cardiac disorders. For example, in one study, some cardiac samples of patients

with dilated cardiomyopathy were positive for presence of adenovirus type 8.

Adenoviruses are often transmitted by expectorate, but can also be transmitted by contact with an infected person, or by virus particles left on objects such as towels and faucet handles. Some people with adenovirus gastroenteritis may shed the virus in their stools for months after getting over the symptoms..

As with many other illnesses, good handwashing practice is one way to inhibit the person-to-person transmission of adenoviruses. Heat and bleach will kill adenoviruses on objects.

Transmission:-

Adenoviruses are unusually stable to chemical or physical agents and adverse pH conditions, allowing for prolonged survival outside of the body and water. Adenoviruses are spread primarily via **respiratory droplets**, however they can also be spread by **fecal routes**. The virus can be passed through water in swimming pools that are not sufficiently chlorinated

Diagnosis:-

Diagnosis is from symptoms and history. Tests are only necessary in very serious cases. Tests include blood tests, eyes, nose or throat swabs, stool sample tests, and chest x-rays. In the laboratory, adenovirus can be identified with antigen detection, polymerase chain reaction (PCR), virus isolation and serology. Even if adenovirus is found to be present, it may not be the cause of any symptoms. Some immunocompromised individuals can shed the virus for weeks and show no symptoms.

Treatment:-

There are no proven antiviral drugs to treat adenoviral infections, so treatment is largely directed at the symptoms (such as acetaminophen for fever). The antiviral drug cidofovir has helped certain of those patients who had severe cases of illness; the number helped and to what degree, and the particular complications or symptoms it helped with, and when and where this happened, were not given in the source.

Vaccines:-

Modified (recombinant) adenovirus vectors, including replication incompetent types, can deliver DNA coding for specific antigens. Recombinant adenovirus type-5 (Ad5) and adenovirus type-26 (Ad26) are being used vectors in candidate COVID-19 vaccines.

The goal is to express the spike glycoprotein of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). A replication-deficient chimpanzee adenovirus vaccine vector (ChAdOx1) is being used in a trial of a COVID-19 vaccine.

2- Papillomaviridae

Papillomaviridae is an ancient taxonomic family of non-enveloped DNA viruses, collectively known as papillomaviruses. Several hundred species of papillomaviruses, traditionally referred to as "types", have been identified infecting all carefully inspected mammals, but also other vertebrates such as birds, snakes, turtles and fish. Infection by most papillomavirus types, depending on the type, is either asymptomatic (e.g. most Beta-HPVs) or causes small benign tumors, known as papillomas or warts (e.g. human papillomavirus 1, HPV6 or HPV11). Papillomas caused by some types, however, such as human papillomaviruses 16 and 18, carry a risk of becoming cancerous.

Papillomaviruses replicate exclusively in the basal layer of the body surface tissues. Papillomaviruses gain access to keratinocyte stem cells through small wounds, known as microtraumas, in the skin or mucosal surface. The virus is then able to get inside from the cell surface via interaction with a specific receptor, and transported to membrane-enclosed vesicles called endosomes.

All known papillomavirus types infect a particular body surface, typically the skin or mucosal epithelium of the genitals, anus, mouth, or airways. For example, human papillomavirus (HPV) type 1 tends to infect the soles of the feet, and HPV type 2 the palms of the hands, where they may cause warts. Additionally, there are descriptions of the presence of papillomavirus DNA in the blood and in the peripheral blood mononuclear cells.

Structure:-

Papillomaviruses are non-enveloped, meaning that the outer shell or capsid of the virus is not covered by a lipid membrane. the capsid is geometrically regular and presents icosahedral symmetry. The papillomavirus genome is a double-stranded circular DNA molecule.

Production of progeny virus:-

The expression of the viral late genes, L1 and L2, is exclusively restricted to differentiating keratinocytes in the outermost layers of the skin or mucosal surface. The increased expression of L1 and L2 is typically correlated with a dramatic increase in the number of copies of the viral genome. Since the outer layers of stratified squamous epithelia are subject to relatively limited surveillance by cells of the immune system, it is thought that this restriction of viral late gene expression represents a form of immune evasion.

New infectious progeny viruses are assembled in the cell nucleus. Papillomaviruses have evolved a mechanism for releasing virions into the environment. Other kinds of non-enveloped animal viruses utilize an active lytic process to kill the host cell, allowing release of progeny virus particles. Often this lytic process is associated with inflammation, which might trigger immune attack against the virus. Papillomaviruses exploit desquamation as a stealthy, non-inflammatory release mechanism.

- Although some papillomavirus types can cause cancer in the epithelial tissues they inhabit, cancer is not a typical outcome of infection. The development of **papillomavirus-induced cancers typically occurs over the course of many years**. Papillomaviruses have been associated with the development of cervical cancer, penile cancer, and oral cancers. An association with vulval cancer and urothelial carcinoma with squamous differentiation in patients with neurogenic bladder has also been noted. There are cancer causing papillomavirus genome that encodes two small proteins called E6 and E7 that mimic cancer causing oncogenes. The way they work is that they stimulate unnatural growth of cells and block their natural defenses. Also they act on many signaling proteins that control proliferation and apoptosis.

Human papillomavirus infection (**HPV infection**) is an infection caused by ***human papillomavirus*** (**HPV**), a DNA virus from the *Papillomaviridae* family. About 90% of HPV infections cause no symptoms and resolve spontaneously within two years.

However, in some cases, an HPV infection persists and results in either warts or precancerous lesions. These lesions, depending on the site affected, increase the risk of cancer of

the cervix, vulva, vagina, penis, anus, mouth, or throat. Nearly all cervical cancer is due to HPV; two strains, **HPV16** and **HPV18**, account for 70% of cases. Between 60% and 90% of the other cancers listed above are also linked to HPV. **HPV6** and **HPV11** are common causes of genital warts and laryngeal papillomatosis.

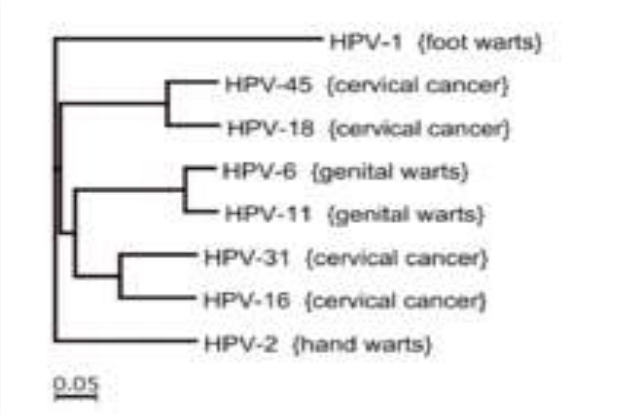
An HPV infection is caused by *human papillomavirus*, a DNA virus from the papillomavirus family. Over 170 types have been described. More than 40 types may be spread through sexual contact and infect the anus and genitals. Risk factors for persistent infection by sexually transmitted types include early age of first sexual intercourse, multiple sexual partners, smoking, and poor immune function. These types are typically spread by sustained direct skin-to-skin contact, with vaginal and anal sex being the most common methods. Also, HPV infection can spread from a mother to baby during pregnancy.

HPV vaccines:- can prevent the most common types of infection. To be most effective, inoculation should occur before the onset of sexual activity, and are therefore recommended between the ages of 9–13 years.

Signs and Symptoms:-

Some HPV types, such as HPV-5, may establish infections that persist for the lifetime of the individual without ever manifesting any clinical symptoms. HPV types 1 and 2 can cause common warts in some infected individuals. HPV types 6 and 11 can cause genital warts and laryngeal papillomatosis.

Many HPV types are carcinogenic. The table below lists common symptoms of HPV infection and the associated strains of HPV.



Notable HPVtypes and associated diseases

Cervical testing:-

Cervical cancer screening, such as the Papanicolaou test ("pap smear"), or examination of the cervix after applying acetic acid, can detect both early cancer and abnormal cells that may develop into cancer. Screening allows for early treatment which results in better outcomes. Screening has reduced both the number of cases and the number of deaths from cervical cancer. Genital warts can be removed by freezing.

regardless of HPV vaccination status. Women aged 30–65 should preferably be tested every 5 years with both the HPV test and the Pap test. In other age groups, a Pap test alone can suffice unless they have been diagnosed with atypical squamous cells of undetermined significance (ASC-US). According to the National Cancer Institute, "The most common test detects DNA from several high-risk HPV types, but it cannot identify the types that are present. Another test is specific for DNA from HPV types 16 and 18, the two types that cause most HPV-associated cancers. A third test can detect DNA from several high-risk HPV types and can indicate whether HPV-16 or HPV-18 is present. A fourth test detects RNA from the most common high-risk HPV types.

These tests can detect HPV infections before cell abnormalities are evident.

Genital warts are the only visible sign of low-risk genital HPV and can be identified with a visual check. These visible growths, however, are the result of non-carcinogenic HPV types. Five percent acetic acid (vinegar) is used to identify both warts and squamous intraepithelial neoplasia (SIL) lesions with limited success by causing abnormal tissue to appear white, but most doctors have found this technique helpful only in moist areas, such as the female genital tract. At this time, HPV tests for males are used only in research.

Research into testing for HPV by antibody presence has been done. The approach is looking for an immune response in blood, which would contain antibodies for HPV if the patient is HPV positive.

Prevention:-

The HPV vaccines can prevent the most common types of infection. To be effective they must be used before an infection occurs and are therefore recommended between the ages of nine and thirteen. Cervical cancer screening, such as with the Papanicolaou test (pap) or looking at the cervix after using acetic acid, can detect early cancer or abnormal cells that may develop into cancer. This allows for early treatment which results in better outcomes. Screening has reduced both the number and deaths from cervical cancer in the developed world. Warts can be removed by freezing

Vaccines:-

Three vaccines are available to prevent infection by some HPV types: Gardasil, Gardasil 9 and Cervarix; all three protect against initial

infection with HPV types 16 and 18, which cause most of the HPV-associated cancer cases. Gardasil also protects against HPV types 6 and 11, which cause 90% of genital warts. Gardasil is a recombinant quadrivalent vaccine, whereas Cervarix is bivalent, and is prepared from virus-like particles (VLP) of the L1 capsid protein. Gardasil 9 is nonavalent, it has the potential to prevent about 90% of cervical, vulvar, vaginal, and anal cancers. It can protect for HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58; the latter five cause up to 20% of cervical cancers which were not previously covered.

3- Parvoviridae :-

It is a family of small, rugged, genetically-compact DNA viruses, known collectively as **parvoviruses**. There are currently more than 100 species in the family, divided among 23 genera in three subfamilies.

Parvovirus B19 was the first pathogenic human parvovirus to be discovered and is best known for causing a childhood exanthem called "fifth disease" (*erythema infectiosum*), although it is also associated with other diseases including arthritis.

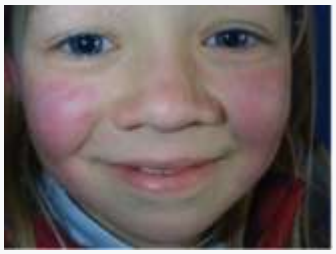
Parvoviruses can infect and may cause disease in many animals, from arthropods such as insects and shrimp, to echinoderms such as starfish, and to mammals including humans. Because most of these viruses require actively dividing cells to replicate, the type of tissue infected varies with the age of the animal. The gastrointestinal tract and lymphatic system can be affected at any age, leading to vomiting, diarrhea, and immunosuppression,

Structure:-

Parvoviruses are linear, nonsegmented, single-stranded DNA viruses,The viral capsid of a parvovirus is icosahedral symmetry. These virions are

typically resistant to dilute acids, bases, solvents, and temperatures up to 50°C (122°F). Parvoviruses do not have envelopes, thus are considered "naked" viruses. In addition, the shape of the virion is roughly spherical, with surface protrusions and canyons.

Diseases:-



Child with fifth disease

Parvovirus B19 which causes **fifth disease in humans**, It infects red blood cell precursors and was the first parvovirus shown to cause human disease. Some infections do not result in visible infection, while some manifest with visible effects, such as fifth disease (erythema infectiosum), which can give children a 'slapped-cheek' appearance.

Parvovirus B19 infection may affect the development of arthritis , Parvovirus infection in pregnant women is associated with hydrops fetalis due to severe fetal anemia, sometimes leading to miscarriage or stillbirth.

Transmission:-

The virus is primarily spread by infected respiratory droplets; blood-borne transmission, however, has been reported. The secondary attack risk for exposed household persons is about 50%, and about half of that for classroom contacts.

Treatment:-

At the moment, there are no treatments that directly target parvovirus B19 virus. Intravenous immunoglobulin therapy (IVIG) therapy has been a popular alternative because doctors can administer it without stopping chemotherapy drugs. However, it is important to note that IVIG therapy is not perfect as 34% of treated patients will have a relapse after 4 months.

Vaccination:-

As of 2017, no approved human vaccine existed against parvovirus B19.