

Adenovirus

Adenoviruses most commonly cause respiratory illness; however, depending on the infecting serotype, they may also cause various other illnesses, such as **gastroenteritis, conjunctivitis, cystitis (bladder infection), and rash illness**. Symptoms of respiratory illness caused by adenovirus infection range from the common cold syndrome to pneumonia, croup, and bronchitis. Young infants and especially patients with compromised immune systems are more susceptible to severe complications of adenovirus infection. **Acute respiratory disease (ARD)**, which was first recognized among military recruits during World War II, can be caused by adenovirus infections. Adenoviruses were first isolated in human **adenoids (tonsils), from which the name is derived**. Adenoviruses represent the largest non-enveloped viruses, because they are the maximum size able to be transported through the endosome. Adenoviruses are medium sized (90-100 nm), non-enveloped icosahedral viruses containing double-stranded DNA. **Family: Adenoviridae**

Classification Contain two genera: -

1- **Mastadenovirus**. Infect the human 2- **Aviadenovirus** Infect birds.

More than 60 serotypes infect human. Adenoviruses are divided into seven Subgroups or species (**A to G**) based on physical, chemical, biological properties.

-Subgroup A: serotype 12, 18 and 31: highly oncogenic and cause sarcoma when injected into new born hamsters.

Properties of adenoviruses

- **Composition:** DNA (13%), Protein (87%). **Genome:** Linear, double stranded DNA, 26-45 kbp. The surface of its capsid consisting of three major proteins; **hexon, penton base and a knobbed fiber**.
- **Hexon & penton** capsomeres are the major components on the surface of the virus particle. Penton base with **toxin-like activity**. **Fibers** –with type– specific antigens; associated with **hemagglutinating activity**.
- Adenoviruses are **unusually stable to chemical and physical agents** and to adverse PH conditions, thus allowing for prolonged survival outside of the body that adenovirus,

Formaldehyde, Heat by **Inactivated while** Dry environment Acid, Detergent, **resistant** Bleach.

Transmission: Adenoviruses are transmitted by several mechanisms

Direct contact, Adenoviruses causing conjunctivitis are very infectious and spread by direct contamination of the eye.

Respiratory droplets. Respiratory adenoviruses are spread by the respiratory route (aerosol droplet, direct and indirect).

Feco-oral route. Enteric adenoviruses are spread via the faecal-oral route.

Viral replication:

- 1- Adenoviruses attach to surface of the cells by their fibers, then penetrate the cell, and once inside the cell, uncoated the viral DNA.
- 2- The viral DNA is then transported into the nucleus of the cell and initiates replication cycle.
- 3- Host cell DNA-dependent RNA polymerase transcribes the early genes leading to formation of functional m RNA.
- 4- Then the cytoplasm, the early m RNA is translated to nonstructural proteins.
- 5- In the nucleus, after viral DNA replication, late m RNA is transcribed and then translated into structural virion proteins.
- 6- This is followed by assembly of virions in the nucleus and release of virions by lysis of the cells, **but not by budding.**

Pathogenesis

Adenoviruses are transmitted mainly by **respiratory or feco-oral contact** from humans. They infect the conjunctiva or the nasal mucosa. They may multiply in **conjunctiva, pharynx, or small intestine**, where epithelial cells are infected. The site of entry generally dictates the type of infection; 2 processes can occur:

These **are (a) lytic infection, (b) latent infection.**

(A) Lytic infection: Adenoviruses infect muco epithelial cells in the respiratory tract, gastrointestinal tract, and conjunctiva or cornea, causing **damage of these cells directly (cell lysis).** After local replication of the virus, **viremia follows with subsequent spread**

to **visceral organs**. Dissemination occurs more commonly in immunocompromised patients than in the immunocompetent individuals.

(B) Latent infection: The adenovirus has unique ability to become latent in lymphoid and other tissues such as adenoids, tonsils, and Peyer's patches. The exact mechanism of latency of adenovirus in this tissue is not known. These latent infections can be reactivated in patients infected with other agents or in the patients who are immunocompromised.

Clinical syndrome: Various syndromes are associated with particular serotypes: -

Respiratory diseases (Pharyngitis and tonsillitis), **Pharyngoconjunctivitis**, Eye disease (Conjunctivitis), **Pneumonia**: in preschool children, **Gastroenteritis** (Gastrointestinal disease), **Acute hemorrhagic cystitis** (bladder infection), **Cervicitis and urethritis**.

Laboratory Diagnosis: Specimens: from throat, eye, urine, feces.

1- **Isolation of virus:** Inoculation into cell cultures; human embryonic kidney/ Hela/Hep. CPE: cell rounding and agglutination into grape like clusters. Others tests: HA, Neutralization, CF.

2- **Serology:** detection of adenoviral antigens by ELISA, Hemagglutination inhibition test, Neutralization tests and Immunofluorescence for antigen detection in nasopharyngeal/ ocular specimens.

3- **Direct detection of Virus** particle by Electron microscopy (EM) in stool Sample.

4- **PCR indicates** adenovirus infection by use type-specific primers can be used to distinguish between different types of adenoviruses.

Treatment: There is no antiviral therapy. Limited efficacy of antivirals (Ribavirin)

Parvovirus

commonly abbreviated to parvo, is a genus of the parvoviridae family linear, non-segmented single strand DNA viruses with an average genome size of 5 kbp. Parvoviruses are some of the smallest viruses found in nature (hence the name, from Latin parvus meaning small).

Properties of Parvoviruses

- Parvoviruses are the smallest DNA

Icosahedral, non-enveloped particles are 18–26 nm in diameter. Virions are extremely resistant to inactivation.

- They are stable between a pH of 3 and 9 and withstand heating at 56°C for 60 minutes, but they can be inactivated by formalin, and oxidizing agents.
- Virions contain two coat proteins; VP1 and VP2.
- The genome is about 5 kb, linear, single-stranded DNA.
- Virions contain either positive or negative-sense strands. They need help from other viruses or from rapidly dividing host cells in order to replicate.

Classification: There are two subfamilies of Parvoviridae:

1- Parvovirinae, which infect vertebrates, which have three genera:

- a) **Parvovirus:** which takes its name from that of the family, and infects only animals and birds;
- b) **Dependovirus:** named for dependence on a helper virus, usually an adenovirus, but occasionally a herpesvirus, to assist in replication.
- c) **Erythrovirus:** which has only one member, known as B19, the only parvovirus causing significant disease in humans; Erythema infectiosum, Fetal infections and Aplastic crises.

2- Densovirinae which infect insects.

Transmission:

- 1-Respiratory route.
- 2- Transmitted by blood transfusions or by infected blood products.
- 3-Vertically from mother to fetus.

Parvovirus Replication:

Only primary erythroid progenitors are known to be permissive for B19 infection. The cellular receptor for B19 is blood group P antigen which is expressed on mature erythrocytes, erythroid progenitors, megakaryocytes, endothelial cells, placenta, and fetal liver and heart, which helps explain the narrow tissue tropism of B19 virus.

Clinical features:

1- Erythema infectiosum (Fifth Disease): This manifestation is most common illness in children of early school age and occasionally affects adults. Fever and mild constitutional symptoms may accompany the rash, which has a typical “slapped cheek” appearance followed by a maculopapular rash on the trunk and limbs, which may persist for 2- or 3-weeks. Joint involvement due to immune complex deposition is a prominent feature in adult cases; joints in the hands and the knees are most frequently affected. The symptoms mimic rheumatoid arthritis. The incubation period is usually 1–2 weeks but may extend to 3 weeks.

2- Transient Aplastic Crisis: Parvovirus B19 is the cause of transient aplastic crisis (with very low haemoglobin and disappearance of circulating reticulocytes) that may complicate chronic hemolytic anemia, such as in patients with sickle cell disease, thalassemias, and acquired hemolytic anemias in adults. Transient aplastic crisis may also occur after bone marrow transplantation.

3-B19 Infection During Pregnancy (Fetal infection): Maternal infection with B19 virus may pose a serious risk to the fetus, resulting in hydrops fetalis and fetal death due to severe anemia. Fetal death occurs most commonly before the 20th week of pregnancy.

Laboratory Diagnosis: Specimen; blood cells, tissue samples, and respiratory secretions.

1- Polymerase chain reaction (PCR), in situ hybridization. PCR is the most sensitive assay.

2-Immunohistochemistry has been used to detect B19 antigens in fetal tissues and bone marrow.

4-Detection of IgM antibody by ELISA indicates a current or recent infection, whereas the much more prolonged presence of IgG is a sign of past infection.

Treatment and Prevention: There is no vaccine against human parvovirus and there is no antiviral drug therapy.