

DNA tumor viruses \ Human Cancer Viruses

Polyomaviruses (Formerly classified in Papovaviridae family)

Classification:

The polyomaviridae family contains a single genus designated polyomavirus, formerly part of the Papovaviridae family (which no longer exists). Polyomaviruses are small viruses (diameter 45 nm) that possess a circular genome of doublestranded DNA enclosed within a non-enveloped capsid exhibiting icosahedral symmetry. Polyomaviruses are simple DNA-containing viruses.

Important Properties of Polyomaviruses

Virion: Icosahedral.

Genome: Double-stranded DNA, circular.

Envelope: None

Replication: Nucleus

Outstanding characteristics:

Stimulate cell DNA synthesis.

Viral oncoproteins interact with cellular tumor suppressor proteins.

Important model tumor viruses.

Human viruses can cause human neurologic and renal disease.

May cause human cancer.

Pathogenesis and Pathology

The human polyomaviruses BK and JC are widely distributed in human populations, as evidenced by the presence of specific antibody in 70–80% of adult sera. Infection usually occurs during early childhood. Both viruses may persist in the kidneys and lymphoid tissues of healthy individuals after primary infection and may reactivate when the host's immune response is impaired, for example, by renal transplantation, during pregnancy, or with increasing age. Viral reactivation and shedding in urine are asymptomatic in immunocompetent persons. The viruses are most commonly isolated from immunocompromised patients, in whom disease may occur.

BK virus causes hemorrhagic cystitis in bone marrow transplant recipients. It is the cause of polyomavirus-associated nephropathy in renal transplant recipients, a serious disease that occurs in up to 5% of recipients and that results in graft failure in up to 50% of those affected patients.

JC virus is the cause of progressive multifocal leukoencephalopathy, a fatal brain disease that occurs in some immunocompromised persons, especially those with depressed cell-mediated immunity resulting from immunosuppressive therapies or infection by HIV. Progressive multifocal leukoencephalopathy affects about 5% of AIDS patients.

PAPILLOMAVIRUSES (Formerly classified in Papovaviridae family)

Important Properties of Papillomaviruses

Virion: Icosahedral.

Genome: Double-stranded DNA, circular, 8 kbp.

Envelope: None.

Replication: Nucleus.

Outstanding characteristics: Stimulate cell DNA synthesis.

Restricted host range and tissue tropism.

Significant cause of human cancer, especially cervical cancer.

Viral oncoproteins interact with cellular tumor suppressor proteins.

Papillomaviruses are highly tropic for epithelial cells of the skin and mucous membranes.

Classification

The Papillomaviridae family is a very large virus family currently divided into 16 genera, of which five contain members that infect humans (Alpha-, Beta-, Gamma-, Mupa-, and Nupa papillomavirus). The papillomaviruses are former members of the Papovaviridae family. Although papillomaviruses and polyomaviruses share similarities in morphology, nucleic acid composition, and transforming capabilities, differences in genome organization and biology led to their separation into distinct virus families. The papillomaviruses are slightly larger in diameter (55 nm) than the polyomaviruses (45 nm) and contain a larger genome (8

kbp vs 5 kbp). The organization of the papillomavirus genome is more complex. There is widespread diversity among papillomaviruses

Pathogenesis and Pathology

Disease: Papillomaviruses cause infections at cutaneous and mucosal sites, sometimes leading to the development of different kinds of warts, including skin warts, plantar warts, flat warts, anogenital warts, laryngeal papillomas, and several cancers, including those of the cervix, vulva, penis and anus, and a subset of head and neck cancers.

HPV genital infections are sexually transmitted and represent the most common sexually transmitted disease. Cervical cancer is the second most frequent cancer in women worldwide and is a major cause of cancer deaths in developing countries. Cervical cancer develops slowly, taking years to decades. It is thought that multiple factors are involved in progression to malignancy; however, persistent infection with a high-risk HPV is a necessary component to the process.

Transmission of viral infections occurs by close contact. Viral particles are released from the surface of papillomatous lesions. It is likely that micro abrasions allow infection of proliferating basal layer cells at other sites or within different hosts.

Prevention and Control

Vaccines against HPV are expected to be a cost-effective way to reduce anogenital HPV infections. Adolescent and young adult females were the initial target population for vaccination, with adolescent and young adult males recommended for vaccination.

It is not known how long vaccine-induced immunity lasts, but it appears to extend for at least 5 years. HPV vaccines are not recommended for pregnant females.

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