Human Papillomavirus (HPV)

By Suzette Emberton

**HPV Infection:** etiological agent of many warts, most cervical cancers, and some cancers of the uterus, vulva, and anus is *Human Papillomavirus* (HPV)

**Transmission:** HPV is a sexually transmitted infection. The virus is spread by direct contact with the mucous membranes or skin of the genitals, perineum, anus, or upper thighs of an infected person. It is possible for HPV to be transmitted through oral sex, but this is quite rare. (2)

**Reservoirs:** infected sexually active humans

**General Characteristics of Microorganism:** Human papilloma virus is a small, nonenveloped virus in the *Papovaviridae* family. It is 55 nm in diameter and has an icosahedral capsid which consists of 72 capsomeres. Each virion has one molecule of double-stranded DNA. (1) HPV is a group of more than 100 viruses that are closely related.

**Key Tests for Identification:** HPV is diagnosed by pap smear, colposcopy, or HPV DNA test. HPV has traditionally been detected in female patients with a pap smear, a test in which a sample of cervical cells is analyzed under a microscope for changes characteristic of HPV virus. This test is done as a routine screening in gynecological exams, even in the absence of HPV symptoms. The pap smear can detect many of the most common high-risk (cancer-causing) and low-risk (benign) serotypes. A colposcopy is another diagnostic test for females in which a health care provider uses an instrument called a colposcope to get a magnified view of the cervix and apply a vinegar solution which causes HPV infected cells to turn white. The vinegar solution can also be used to diagnose HPV in men when HPV infection is suspected in a physical exam. The third diagnostic test, used for both males and females, is an HPV DNA test. A cell sample is analyzed to detect the genetic material of cancer-causing HPV, though the test cannot detect the benign strains of the virus. No simple blood test exists for HPV. (3)

**Signs and Symptoms of Disease:** The most common signs of an HPV infection are cutaneous warts: genital warts; common warts on hands, fingers, or elbows; plantar warts; and flat warts. In most cases the warts are not painful or uncomfortable, though these can sometimes itch. The majority of HPV cases, however, are completely asymptomatic and resolve on their own without the host ever knowing that he or she was infected. (5)

Researchers and physicians have known since the 1970's that HPV is the cause of almost all cases of cervical cancer, although the vast majority of HPV infections are benign. In fact, the World Health Organization states that 99% of the world's cervical cancer cases are caused by a genital HPV infection (7) The strains of HPV that cause cervical cancer do not cause warts and are asymptomatic until the cancer progresses. Because early-stage
cervical is asymptomatic, most women do not know they have it until the cancer is detected in a routine screening. HPV has also been implicated in a small percentage of cancers of the mouth and throat, as the virus can be transmitted via oral sex. (5)

**Historical Information:** The initial discovery that viruses cause warts in humans was made in 1907. In the year 1933, Richard Shope isolated a *Papillomavirus* from rabbits. Despite their early discovery, these viruses were not studied much more until the 1970's. (6) The connection between HPV and skin cancer was first proposed in 1972 by Polish researcher Stefania Jablonska. Jablonska, along with Gerhard Orth, discovered strains of Human Papillomavirus in a skin cancer, thus supporting their hypothesis. Harald zur Hausen hypothesized in 1976 that HPV was a cause of cervical cancer; in 1984 they substantiated their hypothesis by isolating HPV 16 and HPV 18 in cervical cancer. HPV has been part of many discussions, including a good deal of controversy, since the approval of a vaccine in the early 2000's. The vaccine will be discussed in the **Prevention/Vaccine** section below.

**Virulence Factors:** Virulence factors in high-risk HPV are the proteins E6 and E7. These proteins deactivate the host's tumor suppressor proteins p59 and Rb. As the name indicates, when tumor suppressor genes are turned off, the cells divide at an out-of-control rate and form malignant tumors. (4)

**Control/Treatment:** Patients with healthy immune systems are usually able to fight off the virus without treatment in a short period of time. No treatment exists for the virus itself, although warts and abnormal cells can be removed or treated with over-the-counter or prescription topical creams.

The topical treatments work by destroying wart tissue and/or boosting the body's immune response to the virus. Removal techniques include: freezing with liquid nitrogen (cryotherapy), burning with electrical current (electrocautery), surgical excision, and laser surgery. Pre-cancerous lesions sometimes heal without treatment, while some must be removed. (5)

**Prevention/Vaccine:** The spread of HPV can be difficult to prevent because many infected people are asymptomatic, and hence unaware that they could infect others. The use of latex condoms is very effective, though not completely failsafe, in preventing the spread of HPV as well as many other sexually transmitted infections. Also, being in a mutually monogamous relationship has been shown to greatly reduce the risk of HPV. To prevent cervical and other cancers related to HPV infections, women should have annual check-ups that include a pap smear or other cancer screening.

The best way to prevent an HPV infection is to be vaccinated in a series of three shots over a six month period. The vaccines have been designed to provide immunity for both males and females, regardless of sexual orientation. It is recommended that all boys and girls ages 11 or 12 should be vaccinated. For those who were not vaccinated as pre-teens, "catch-up" vaccines are available up through age 26. The vaccines are safe and effective and have been shown to provide immunity against strains of HPV that cause cancer. (8)
Local Cases or Outbreaks (with incidence figures): HPV is the most common STD, with the majority of sexually active adults having an infection at some point in their lives. According to the CDC, 79 million Americans are currently infected, with approximately 14 million new cases being diagnosed each year. It is noted that 360,000 people suffer from genital warts each year, and 11 women will be diagnosed with cervical cancer each year. (8)

Global Cases or Outbreaks (with incidence figures): It is difficult to assess the number of cases worldwide, due to lack of reporting, lack of regular screenings, and other medical infrastructure in developing countries. It is estimated that, worldwide, HPV is implicated in approximately 99% of cervical cancers. In developing countries, HPV-related cancers are the leading cause of cancer deaths in women. Worldwide, these are the second-leading cause of cancer deaths in women. (4)

REFERENCES:


