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viruses measure a mere fifteen nanometres (0.000 015 millimetres), while pox viruses, giants by virus standards, measure 300 nanometres. Apart from the pox viruses, viruses can only be visualised as individual particles under the electron microscope – the most powerful of microscopes.

Bacteria are tiny living organisms comprising a single cell of relatively simple design – there is no nucleus, and genetic material is scattered throughout. Many thousands of species of bacteria are associated with human bodies but only some cause disease. Fewer again exploit sexual intercourse as a primary method of transmission. Bacteria are not individually visible to the naked eye, but most are easily visualised with a standard microscope.

Parasites are more complex. Some parasites, like protozoa, are single cells, but their individual cells are more intricate than those of bacteria, and their genetic material is segregated within a nucleus. Others are multicellular organisms, for example the pubic louse, which is visible to the naked eye and has many body parts and organs.

Viruses

Herpes

Herpes is caused by the herpes simplex viruses, of which there are two types, herpes simplex virus type 1 (HSV 1) and herpes simplex virus type 2 (HSV 2). While the two viruses are very similar, HSV 1 is well adapted for infecting the mouth, throat, and nose, and HSV 2 is better adapted for genital sites. However, each virus is capable of infecting either the oral or the anogenital site. Once infection with one strain has occurred, that strain cannot be acquired again, although infection with the other strain may still occur. A common pattern is the acquisition of HSV 1 on the lips during childhood, and then acquisition of HSV 2 on the genitals in early adulthood.

Genital herpes is easiest to recognise when it appears as groups of tiny, painful blisters which burst to leave shallow ulcers on inflamed and red genital skin. This description is well known but represents only about 20% of people who have genital herpes. A further 20% have no symptoms whatsoever, and the remaining 60% have 'atypical' herpes, with lesions varying from mild tingling to redness or swelling, or tiny fissures in the genital skin. Not surprisingly, those with genital herpes are usually unaware of their infection.

When the herpes virus is transferred to a susceptible host, it enters through tiny abrasions commonly found in genital skin, especially after sexual activity. Here the virus multiplies in the skin cells of the new host. An immune reaction to the viruses causes an increase in blood flow, and leakage of serum from blood vessels into the infected tissues, leading to the appearance of tiny blister groups on a red, painful, and swollen base, with enlarged lymph nodes in the groin. The blisters burst leaving erosions or ulcers in the affected part which heal over a few days. During this process, passage of urine over the broken skin may be painful.

Herpes infections are generally mild and rarely endanger human life. Those having their first herpes episode may be very unwell, and rare complications can be serious, such as infection of the neonate, where the risk of death or permanent disability is high.

Clinicians divide episodes of herpes into three groups: primary, initial, and recurrent.

- Primary episodes of genital herpes occur when an individual without prior exposure to either of the herpes simplex viruses is initially infected. These episodes tend to be more severe than other episodes, with possible extensive genital ulceration and pain. The infected person experiences a generalised immune response, with fevers, headaches, and lethargy, much like influenza. Those experiencing these episodes occasionally require hospitalisation.
- Initial episodes occur in individuals already infected with HSV 1 – usually around the mouth and nose. The virus is partially recognised and so the attack is more like a recurrence than a primary infection.
- The hallmark of genital herpes is its ability to recur. Around 95% of those infected with HSV 2 on their genitals will experience recurrence. After the initial entry of herpes virus into the skin, some virus is transported to the spinal cord, where it infects specific cells and remains in a dormant state. Periodically, triggers (the nature of which are only partly understood) allow the virus to again leave the spinal cord, travel down the nerves, and replicate in genital skin. Skin lesions such as blisters, redness, swelling, and pain reappear. Recurrences are much less severe than the primary infection. There is some immunological memory of the virus so the episode is usually quickly brought under control. Symptoms of fever, headache, and malaise are usually absent from recurrences. With each successive recurrence, the episode tends to be briefer and the symptoms less severe. The frequency of recurrences decreases with time.

Among older generations, HSV 1 was almost universally transmitted during childhood, and resulted in orolabial herpes (otherwise known as cold sores), completely asymptomatic infection or, most commonly, subclinical or atypical manifestations such as dry or cracked lips, a tiny lesion on the border of the lip, tingling, or fissures. About 75% of adults show serological evidence of having infection with HSV (Cunningham *et al.* 2006). As a result of smaller family sizes, improved hygiene, and better parent education, younger generations are increasingly entering adulthood without exposure to HSV 1. Approximately half of all new genital herpes infections in adolescents and young adults are with HSV 1, probably due to increasing acceptability of oral sex. HSV 2 is almost always sexually transmitted, and is most commonly found on the anogenital skin and adjacent areas. Diagnosis of herpes is best done by recovering the virus from the suspicious site. Serological tests that look for virus antibody are not suitable for routine testing, and are best used by clinicians with a specialist interest in herpes infections and sexual health.

Treatment and prevention

Treatment of herpes focuses on reducing the number and severity of outbreaks. Herpes is not curable, but for most individuals the infection is manageable. Currently three antiviral drugs are routinely used for treatment of genital herpes. Aciclovir, valaciclovir, and famiciclovir are all effective drugs for reducing severity and frequency of episodes. They can be used continuously to prevent outbreaks, or episodically to shorten or abort outbreaks. Treatment is individually tailored to suit the client with herpes. Local measures to reduce pain and ease urinary difficulty are useful for those with these symptoms.

Prevention of herpes is aimed at minimising the chance of transferring viral particles from the skin of an infected person to the skin of a susceptible partner. This is best achieved by a combination of methods. Crucial to this is the understanding that even when genital skin might look and feel normal, viral particles may still be present, a phenomenon known as asymptomatic viral shedding. Also critical in herpes prevention is the recognition that most people who transmit herpes to another do not know that they are infected, and are without a readily recognisable lesion at the time of transmission.

During herpes outbreaks, virus is expected to be found on the skin, and abstinence from sexual contact is advisable. Sexual activity can resume, preferably with a condom, once the lesions are healing, dry, and crusted over.

Routine use of condoms appears to be one way of reducing transmission of virus during periods of asymptomatic shedding, but they do not completely eliminate transmission. Virus may still be shed from the genital skin outside the boundaries of the condom's coverage.

It has long been thought that medications are capable of decreasing the risk of transmission, largely because they dramatically reduce the number of herpes recurrences and also reduce the amount of asymptomatic viral shedding. A study examining the effect of daily treatment with the anti-herpetic drug valaciclovir confirmed it reduced transmission by half (Corey *et al.* 2004).

Warts

Genital warts are caused by strains of HPV. There are over one hundred strains (genotypes) of HPV, and over 30 of these are known to affect genital skin. Genital warts appear as cauliflower-like growths and can appear as single lesions, or as clusters (Plate 3). They are usually small, but sometimes attain considerable size.

Most unvaccinated humans will acquire HPV on their genitals during their sexual career. While HPV is very common, warts themselves are not nearly as common. Most of those infected with HPV will never develop a wart, but simply have a small amount of virus present within their skin cells. This asymptomatic infection allows passage of virus to new hosts without the original host ever knowing the virus was present.

Although HPV infection is usually benign and self-limiting, an important exception is the role of HPV in cervical, anal, and other genital and extragenital cancers. HPV can prolong the lives of individual cells and promote cell

growth by division. These processes lead to the familiar clinical appearance of a protrusive, knobbly outgrowth of tissue – the wart. Some HPV strains immortalise infected cells in the process of oncogenesis, or cancerous transformation. These cells replicate very quickly, escape immune controls, and invade the surrounding tissues. Eventually, they may spread through blood and lymphatic vessels to invade distant organs.

The incidence of cervical cancer in Australia has drastically declined over the past twenty years, due almost entirely to Papanicolaou (Pap) smear screening programs (named after George Papanicolaou, the Greek-American pathologist who developed the technique). The principle behind the Pap smear is the detection of the cellular changes associated with HPV infection and cancer formation. Almost all women who die of cervical cancer have either never been screened, or have been inadequately followed up. The role of HPV testing in the screening of asymptomatic women and assessment of cervical abnormalities is evolving and is expected to assume a greater role in future guidelines.

While the rates of cervical cancer have reduced, anal cancer rates have increased. Risks for anal cancer include immunosuppression, receptive anal sex, and acquisition of oncogenic HPV in either anal or genital sites. Risk groups include men who have sex with men, particularly if they are HIV-infected. Women with oncogenic HPV infection and risk factors for cervical cancer are also at higher risk. There is interest in the utility of screening programs for anal cancer, although this is controversial. It is hoped that universal vaccination will eventually reduce anal cancer rates.

Treatment and prevention

Several treatments for warts exist, none of which is entirely satisfactory. Treatments are destructive, surgical, or immune-modulating. Destructive therapies involve destroying the warty tissue by physical or chemical means. Physical methods include freezing the warts with liquid nitrogen, and burning warts with electrodesiccation or laser. Chemical methods include painting the warts with toxins such as podophyllotoxin, or trichloroacetic acid. Surgical methods involve excising the warts under anaesthetic cover by scissor excision, laser, and diathermy.

Immune-modulating therapy currently involves using imiquimod, a topical cream that boosts the release of immune-stimulating chemicals and triggers an immune response against the warts.

Each therapy has its benefits and drawbacks, which must be considered in light of the individual's wishes and finances as well as the clinic's resources, and the features of the warts being treated.

In unvaccinated individuals prevention of HPV is difficult because of its widespread and largely silent nature. Those with visible warts predictably shed high amounts of virus, and should abstain from sexual contact with new unvaccinated partners until the lesions are resolved. Condoms are partially protective against HPV and, when used consistently, are helpful in

decreasing HPV transmission from asymptomatically infected partners. Women over the age of 18–20 years or who have been sexually active for more than 2 years (whichever is the latter) should have routine Pap smears every 2 years until the age of 70 to detect pre-malignant lesions and prevent progression to cervical cancer.

Vaccines against selected genotypes of HPV have been created using particles comprised of HPV proteins. Australia introduced a school-based vaccination program with catch-up for women in 2007, and commenced a similar program for boys in 2013. The vaccine used in Australia contains proteins from the two most common genotypes responsible for genital warts (HPV 6 and 11), and the two most common genotypes responsible for cervical and anal cancers (HPV 16 and 18) (Therapeutic Goods Administration (TGA) 2012). The women's vaccination program has significantly reduced the incidence of genital warts among both vaccinated women and their male partners, so-called 'herd immunity'. The anticipated effects on cervical and anal cancers will take much longer to demonstrate, as there is a long lag-time between acquisition of HPV and development of cancer.

HIV

Human immunodeficiency virus, or HIV, is one of a group of viruses called retroviruses. As its name suggests, untreated HIV will lead to the depletion of immune function. This can lead to the emergence of some very unusual infections and cancers, which together make up the acquired immune deficiency syndrome (AIDS). HIV infection was once almost universally fatal, as virtually all those infected would eventually develop AIDS and die. Since 1996, however, the development of new drugs to arrest HIV replication has dramatically improved the outlook of those living with this infection. With access to treatment and medical management, most individuals newly diagnosed with HIV can view their infection as a chronic, manageable disease.

About 25 000 individuals are living with HIV in Australia, of whom about 10% are women. Approximately 80% of those with HIV list male-to-male sexual contact, and 5% list injecting drug use, as a risk factor for acquiring the infection. Australia differs significantly from other regions of the world with respect to HIV epidemiology. Heterosexual transmission is more common in Africa and Asia, and transmission by injecting drug use is more common in southern Europe. Australia has a relatively low rate of HIV infection, with prevalence rates of 115 per 100 000 population per annum (Kirby Institute 2012).

Diagnosis of HIV infection usually involves testing of blood samples for antibody to HIV. Rapid testing using blood or saliva is an emerging diagnostic technology.

Treatment and prevention

Treatment of HIV usually involves three or more different drugs, known as antiretrovirals. Combinations of these drugs have a spectacular effect on

decreasing the ability of HIV to replicate, and in 1996 the term 'highly active antiretroviral therapy' (HAART) was coined. In the absence of HIV replication, the immune system is protected from further destruction and in most individuals reconstitutes itself to a state near normality. HIV treatment is highly specialised and rapidly evolving. Despite the outstanding advances in therapy, HIV is incurable. Eliminating latent HIV from reservoir sites and altering immune responses to HIV are emerging fields of research. Sustaining long-term management plans based on chronic disease models of care remains the major focus of HIV management.

HIV prevention is simple in concept, but sustaining the motivation of individuals to use safe sex indefinitely is challenging, even when the consequences of not doing so are as serious as HIV infection. Avoidance of contact with infected body fluids is the underlying principle. This entails consistent use of condoms for penetrative sexual activity and the use of uncontaminated injecting equipment. Transmission from mother to child is preventable in most cases with a combination of antiretroviral medications and skilled obstetric management. There is great interest in the role of biomedical interventions to interrupt HIV transmission. Microbicides and vaccination are under investigation, and pre- and post-exposure prophylaxis are being used to varying degrees in clinical practice. HIV treatment itself significantly reduces transmission to sexual partners, and the strategy of 'Treatment as Prevention' aims to improve the individual health of people living with HIV, as well as improving public health through reducing transmission.

Molluscum

Molluscum is a benign infection caused by the molluscum contagiosum virus. Mollusca are small, rounded greyish domes that appear on the skin of the genitals and surrounding areas. On close inspection they are observed to have a tiny central 'pore'. While usually sexually transmitted among adults, they are common in children with close personal contact during play. In those with deficient immune systems, mollusca can reach enormous proportions and become disfiguring.

Molluscum is easily treated with paints such as podophyllotoxin, or by local destruction such as freezing with liquid nitrogen. Left alone, mollusca resolve spontaneously. Prevention involves avoidance of sexual contact while lesions are visible, but, as with HPV infection, many of those infected have entirely normal-looking skin. Condoms offer partial protection to the areas underneath the condom.

Hepatitis A

Hepatitis A is caused by the hepatitis A virus. While the majority of infections are not due to sexual transmission, the virus can be transmitted during sexual activities.

After entering the mouth, hepatitis A is absorbed from the gastrointestinal tract and transported to the liver, where it rapidly multiplies. The liver is

subsequently damaged and symptoms of hepatitis follow: jaundice, fever, abdominal pain, lethargy, and nausea. There is reasonably rapid immune control of the virus and it is completely eliminated from the host. While actively replicating, very large amounts of new virus are released into the gastrointestinal tract. These are passed into the environment in faeces. Hepatitis A enters a new host by ingestion of food contaminated with faecal material, via contaminated fingers or directly through oro-anal contact. The practice of oro-anal contact, 'rimming', leads to epidemics of hepatitis A periodically within communities of men who have sex with men. Hepatitis A may also be spread to the mouth on contaminated fingers, for example when eating or smoking after anal sex. Hepatitis A is reasonably stable in the environment and can remain infectious for relatively long periods outside the host's body, leading to the widespread contamination of environments such as sex-on-premises venues during epidemics.

Prevention is achieved through scrupulous food hygiene, avoidance of food preparation by infected individuals, and vaccination of vulnerable groups. All susceptible men who have sex with men should be offered vaccination if there is a risk of hepatitis A.

Hepatitis B

Hepatitis B is a potentially life-threatening infection caused by hepatitis B virus. The pathology and natural history of hepatitis B infections are complex. When acquired in adulthood, most of those infected will clear the virus or control it sufficiently to avoid liver damage. A small percentage will develop chronic hepatitis and subsequent cirrhosis, liver failure, or liver cancer. Other infected adults will fail to clear the virus completely, remain infectious yet asymptomatic, before developing chronic hepatitis many years later.

When acquired via mother-to-child transmission, hepatitis B infection is less likely to be cleared through immune mechanisms and chronic infection is the common outcome.

Hepatitis B is spread through infected body fluids. Transmission occurs during sexual intercourse (vaginal, anal, and probably oral to a lesser extent), shared injecting equipment, or from mother to child at the time of birth.

In Australasia, hepatitis B is found more commonly among those originating from areas where hepatitis B is endemic, which includes much of South East Asia, Africa, and South America. Within Australasia, some ethnic groups have a higher incidence of hepatitis B, such as Australian Indigenous populations and Maoris. Mother-to-child transmission is the most common transmission route in these groups. Other groups at risk of hepatitis B include injecting drug users, men who have sex with men, and those who have a high rate of sexual partner change. In these groups, adult acquisition predominates. Approximately 200 000 people in Australia live with hepatitis B, giving a national prevalence of 1.9% (Kirby Institute 2012). Rates of newly diagnosed hepatitis B in Australia are comparatively low at 0.8 cases per 100 000.

Diagnosis of hepatitis B is with demonstration of viral particles, antibodies to viral particles, and hepatitis B DNA in blood tests, but interpretation of hepatitis B tests can be complex.

Treatment and prevention

Hepatitis B treatments are improving, and significant proportions of those with active hepatitis B will arrest the damage to their liver before significant scarring (cirrhosis) has occurred. Therapy is usually life-long, and aimed at suppressing viral replication rather than cure. A small proportion of people are suitable for treatment with interferon, which may provide a functional cure. Some drugs used in HIV treatment are also used for hepatitis B, although the two viruses are not closely related. Those who have controlled the virus themselves do not require treatment unless they subsequently become immunosuppressed. Those with asymptomatic hepatitis B require careful monitoring for progression of their infection, development of cirrhosis and liver cancer, and to assess their need for treatment.

Vaccination is a safe, effective and inexpensive way of inducing immunity to hepatitis B. Vaccination programs for high-risk groups, such as injecting drug users, men who have sex with men, and the children and partners of chronic carriers have been ongoing in Australia for many years. Hepatitis B has been incorporated into the childhood vaccination schedule. Management of babies born to mothers with hepatitis B is effective in reducing mother-to-child transmission but requires identification of infected mothers through screening of pregnant women.

Condoms are very effective at preventing the sexual transmission of hepatitis B, and the use of sterile equipment is similarly effective at preventing blood-to-blood transmission during injecting drug use or medical procedures. Household spread of hepatitis B is thought to result from sharing instruments with minute blood staining, such as razors, toothbrushes, and nail-clippers.

Hepatitis C

Hepatitis C is transmitted almost exclusively through blood-to-blood contact. Heterosexual transmission of hepatitis C is rare, but those with hepatitis C should abstain from sex during menstruation, and avoid sexual activities that involve blood. Clusters of epidemiologically linked cases of sexually transmitted hepatitis C have been described among men who have sex with men. In particular, associated risks include HIV infection, other STIs, and so called esoteric practices, such as group sex, fisting, and using sex toys.

Treatment of hepatitis C is rapidly evolving. Current therapy involves the combination of interferon and ribavirin, but is associated with poor tolerability, side-effects, and poor efficacy in many circumstances. New agents targeting different steps in the replication cycle of hepatitis C recently became available, and more are being developed. It is hoped that newer agents in combination will eventually provide tolerable, curative therapy without interferon.

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