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8.5.28 Molluscum contagiosum 949 Fig. 8.5.27.4 Herpetic whitlows on adjacent fingers. Courtesy of the late Dr B. E. Juel-Jensen. Impetigo, pyogenic granuloma, cutaneous anthrax, fungal or atypical mycobacterial infection, and tumours might also cause confusion. Treatment Lesions are usually self-limiting. Secondary infection should be treated if it occurs. Large lesions can be removed surgically, but recurrence can occur in the immunocompromised. Cidofovir (topically or intravenously) and imiquimod (topically) have been used successfully to treat giant or persistent lesions, especially in immunosuppressed patients. Prevention Live attenuated virus vaccines have been used to protect sheep and goats from orf. Farmers should avoid handling animals with obvious lesions. FURTHER READING Chakhunashvili G, et al. (2018). Parapoxvirus infections in the country of Georgia: a case series. *Am J Trop Med Hyg*, 98, 1870–75. Diven DG (2001). An overview of poxviruses. *J Am Acad Dermatol*, 44, 1–14. Groves RW, Wilson-Jones E, MacDonald DM (1991). Human orf and milkers' nodule: a clinicopathologic study. *J Am Acad Dermatol*, 25, 706–11. Haig DM (2006). Orf virus infection and host immunity. *Curr Opin Infect Dis*, 19, 127–31. Hautaniemi M, et al. (2010). The genome of pseudocowpoxvirus: comparison of a reindeer isolate and a reference strain. *J Gen Virol*, 91, 1560–76. Joseph RH, et al. (2015). Erythema multiforme after orf virus infection: a report of two cases and literature review. *Epidemiol Infect*, 143, 385–90. Torfason EG, Gunadóttir S (2002). Polymerase chain reaction for laboratory diagnosis of orf virus infections. *J Clin Virol*, 24, 79–84.

8.5.28 Molluscum contagiosum David A. Warrell and Christopher P. Conlon ESSENTIALS Molluscum contagiosum is caused by a Molluscipox DNA virus which infects keratinocytes of the epidermal stratum spinosum, producing distinctive small umbilicated papules on the skin. Its genome encodes a variety of proteins that suppress the host's immune response. In children it is spread by skin contact, producing few or many lesions, while in sexually active adults it causes anogenital lesions. Molluscum is self-limiting within a few years in the immunocompetent, but those with preexisting atopic eczema and immunosuppression, notably AIDS, commonly develop persistent diffuse eruptions with larger papules. Lesions can be removed mechanically or chemically. More severe infections can be treated with imiquimod or cidofovir. Aetiology Molluscum contagiosum, first described clinically in the early 19th century, is caused by a virus of the genus Molluscipox. This large (200–300 nm

long), brick-shaped, double-stranded DNA virus, is a member of the Chordopoxvirinae subfamily of the Poxviridae. It multiplies in the cytoplasm of keratinocytes of the deep epidermal stratum spinosum. Molluscum contagiosum shares unique genomic features with parapoxviruses such as orf (Chapter 8.5.27), including a high guanine-cytosine content, three orthologous genes, and a paucity of nucleotide metabolism genes. Restriction endonuclease analysis of the genome has identified four types (I, II, III, and IV). Types I and IV are the most common types clinically but type II is more common in the setting of HIV infection. Like orf virus, Molluscum contagiosum encodes several proteins that suppress host immunity. MC054L is a human (IL-18) binding protein homologue. MC148 antagonizes CC chemokine receptor 8. MC013L promotes viral replication by inhibiting the differentiation of infected keratinocytes. MC159L causes abnormal proliferation of epithelium by inhibiting tumour necrosis factor and apoptosis-inducing factors. MC080R, an MHC class I homologue, might interfere with natural killer cell activity. Molluscum contagiosum has not been transmitted to laboratory animals and, at present there is no cell culture system in which to propagate the virus. It has been grown in human foreskin grafted to athymic mice. Epidemiology Molluscum contagiosum has a worldwide incidence of 2–8%. It also affects animals: chimpanzees, kangaroos, dogs, horses, and birds. In tropical climates, it is more common in younger children (1–4 years), and in temperate climates, in older school-age children (10–12 years). The prevalence in American children is less than 5%. It is highly contagious by skin-to-skin contact, especially in humid and unhygienic conditions. Fomites such as shared towels, the use

950 section 8 Infectious diseases of communal bathtubs and swimming pools, contact sports such as wrestling, and tattooing, all promote infection. Lesions are spread over the body by autoinoculation. Vertical transmission has also been reported. Sexual transmission accounts for a second peak of incidence in young adults. The risk and extent of infection is increased in those with generalized skin diseases such as atopic eczema and in those with congenital or acquired immunodeficiency, caused by HIV, lymphomas, sarcoidosis, organ transplantation, and immunosuppressive therapy. In HIV seropositive people, the prevalence of molluscum contagiosum is 5–20%, but in those with CD4 cell counts below 100/ml it increases to 30%. Clinical features The incubation period varies from 7 days (in newborns) to 50 days or even up to 6 months. The classic lesion is a painless, discrete, shiny, pearly, hemispherical, firm papule with a central umbilication (depression). In immunocompetent children, lesions can occur singly but are commonly multiple, fewer than 30 to several hundred (Figs. 8.5.28.1, 8.5.28.2). They grow gradually to a diameter of 3–5 mm over 6–12 weeks. A grey-white creamy material might be extruded if a lesion is squeezed. Occasionally, a single lesion may grow to 1.5 cm in diameter, or a plaque of very small lesions develops (agminate form). The average duration of single lesion is about 2 months, but lesions may continue to appear for 6–8 months. Spontaneous clearance is complete without scarring within 2–4 years. In about 10% of cases, especially where there is a history of atopy, a patchy erythema or dermatitis develops around the lesions, causing itching which encourages scratching and autoinoculation. Lesions are most commonly seen on the axilla and other flexures, trunk, neck, or face, but any part of the skin can be affected. Conjunctival inoculation may result in unilateral conjunctivitis or corneal or conjunctival nodules. Lesions are rare on the palms, soles, and buccal mucous membrane. In immunocompetent sexually active teenagers and adults, infections usually result in anogenital lesions. In patients with HIV and other types of immunosuppression, molluscum can be widespread and lesions numerous, but particularly involves the face (eyelids), neck, trunk, and around and inside the mouth in men who have sex with men. Lesions often lack the classic umbilication and may become so large, atypical, and even necrotic that they are mistaken for basal cell carcinomas or other skin tumours. The

disease persists and spreads, especially when HIV is advanced. The use of topical steroids and calcineurin inhibitors for atopic eczema can lead to a high number of lesions in the abnormal skin.

Diagnosis The diagnosis is usually clinical and the lesions might best be examined with a dermascope, but histological and electron microscopic examination of a curetted papule establishes the diagnosis. The demarcated lesion shows lobules of epidermis, depleted of Langerhans cells, penetrating down to the dermis with a central crater opening onto the surface through a narrow pore (Fig. 8.5.28.3). It contains keratinocyte debris with numerous Fig. 8.5.28.1

Molluscum contagiosum: cluster of lesions in an immunocompetent child. Courtesy of Dr Susan M. Burge. Fig. 8.5.28.2 Molluscum contagiosum: characteristic papules with central punctum. Courtesy of Dr Susan M. Burge. Fig. 8.5.28.3 Molluscum contagiosum showing the characteristic demarcated lesion. Courtesy of K. Hollowood.

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