Comprehensive Review of Molluscum Contagiosum in Children: Prevalence, Transmission, Clinical Features, and FDA-Approved Treatments

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Abstract

Background: Molluscum contagiosum (MC) is a common viral skin infection affecting school-aged children, with a prevalence of 2-8%. Although self-limited, MC often requires active management to prevent spread, scarring, and to address cosmetic and social concerns. Traditional treatments have various complications, and currently, only topical berdazimer gel and cantharidin are approved by the FDA. Methods: A comprehensive literature review was conducted to assess the prevalence, transmission, clinical presentation, complications, and treatment options for MC. The review included studies from various geographic regions, focusing on both physical and chemical treatment methods, as well as newer FDA-approved therapies. Results: MC is most prevalent in children aged 2-5, with no gender-specific differences. The infection manifests as skin-colored, dome-shaped papules, primarily on exposed skin. Complications include school exclusion, social isolation, and secondary infections. Treatment options vary widely in efficacy and safety. Physical treatments like curettage and cryotherapy are effective but can cause scarring and discomfort. Chemical treatments, including potassium hydroxide and cantharidin, offer non-invasive

Significance | Molluscum contagiosum significantly affects children, necessitating effective treatments to manage symptoms, prevent complications, and improve quality of life.

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alternatives but have side effects. Newer treatments like topical berdazimer gel and cantharidin solution are promising due to their ease of use and lower complication rates. Conclusion: MC is a significant infection in children, often necessitating treatment due to its complications. While traditional treatments have notable drawbacks, FDA-approved topical therapies, berdazimer gel, and cantharidin, provide effective and safer options. Further research is needed to optimize treatment protocols and minimize adverse effects.

Keywords: Molluscum Contagiosum, Pediatric Skin Infections, Viral Skin Infection Treatment, Berdazimer Gel, Cantharidin

Introduction

Skin and soft tissue infections present a considerable burden on public health due to their potential for severe complications, including hospitalization, surgical intervention, bacteremia, and, in extreme cases, death (Kaye et al., 2019). Among these infections, viral skin infections (VSIs) represent a significant global concern. In 2010, VSIs had an incidence of 122,601,000 cases, ranking them among the top 50 most prevalent disorders worldwide (Saleh et al., 2019). Common VSIs include herpes simplex, herpes zoster, molluscum contagiosum, anogenital warts, and viral warts.

Molluscum contagiosum (MC) is the most prevalent viral skin infection among school-aged children, affecting approximately 2-8% of this population (Uçmak et al., 2014). Unlike other viral

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infections, MC is characterized by a localized and chronic nature (Qureshi et al., 2016). Despite being generally benign, MC can cause significant concerns, prompting parents to seek active therapy to prevent spread, alleviate symptoms, and avoid scarring. The appearance of these lesions can lead to social stigma and anxiety for both the child and their parents (Chathra et al., 2015).

Treatment options for MC include various methods such as mechanical destruction through curettage, cryotherapy, or evisceration; chemical destruction using agents like potassium hydroxide (KOH) or cantharidin; immunomodulatory treatments like topical imiquimod, tretinoin, and oral cimetidine; and the antiviral drug cidofovir (Chathra et al., 2015). Each method has its advantages and limitations, and the choice of treatment often depends on the severity of the infection, patient age, and other individual factors.

2. Epidemiology

Worldwide, MC is more common in children, while it can also affect adults and adolescents. It rarely occurs in infants under the age of one year and frequently affects kids between the ages of 2 and 5. No gender-specific differences exist. There are few statistics on the prevalence of MC. An overall prevalence of 8.28% was found in a meta-analysis of cross-sectional surveys of children, with a higher incidence in regions with warm climates. The results of the enzymelinked immunosorbent assay (ELISA), which measures seroprevalence, vary depending on the population. An Australian study found that 23% of children and adults were overall seropositive for MCV. 14.8% in children and adults aged 0 to 40 in Germany, and 30.3% in a group of 30 healthy British people with a mean age of 27 years. 6% of a Japanese population in good health (Meza-Romero et al., 2019).

In Egypt a cross-sectional study by Ramadan Saleh et al. includes 1000 patients who attended a dermatology clinic at Sohag University Hospitals the prevalence of molluscum contagiosum was 2.7 % (Saleh et al., 2019).

3. Overview of Molluscum Contagiosum Infection

Molluscum contagiosum is a persistent, localized infection caused by the Molluscum contagiosum virus (MCV), a member of the poxvirus family. The infection leads to the development of skincolored, dome-shaped papules that are typically 2-5 mm in size (Stuart N Isaacs, 2023). These lesions are commonly found on exposed areas of the skin, including the trunk, extremities, genitalia, and face in children, and the lower abdomen, thighs, genitalia, and perianal region in adults. While the oral mucosa is rarely affected, lesions may occasionally present with pruritus and an erythematous halo. MC predominantly affects children but can also impact adolescents and adults. It is rare in infants under one year old but becomes more common between the ages of 2 and 5. There is no significant gender difference in prevalence. A meta-analysis of cross-sectional surveys indicates an overall prevalence of 8.28% among children, with higher rates in warmer climates. Seroprevalence studies reveal varied results: 23% in Australia, 14.8% in Germany, 30.3% in the UK, and 6% in Japan (Meza-Romero et al., 2019). In Egypt, a study found a prevalence of 2.7% among 1000 patients attending a dermatology clinic at Sohag University Hospitals (Saleh et al., 2019).

5. Mode of Transmission

MCV spreads through direct skin-to-skin contact, which can occur during both sexual and nonsexual interactions or through autoinoculation. The infection can also be transmitted via contaminated objects such as towels or bath sponges, and has been linked to swimming pool usage (Meza-Romero et al., 2019).

6. Clinical Picture

MCV infection manifests as firm, spherical papules that are pink or skin-colored with an umbilicated, shiny surface. Lesions can appear singularly, in clusters, or in multiples, and may occasionally have a pediculated appearance or an erythematous halo. While lesions are often asymptomatic, pruritus can occur. In children, common sites include the trunk, extremities, intertriginous areas, genitalia, and face, with rare involvement of the oral mucosa. In adults, lesions are more likely to appear on the lower abdomen, thighs, genitalia, and perianal region, often spread through sexual contact. Genital lesions in children can result from autoinoculation rather than sexual abuse (Meza-Romero, Navarrete-Dechent, & Downey, 2019).

Molluscum contagiosum (MC) can significantly impact the quality of life for children affected by the infection. Evidence suggests that around 10% of children with MC experience serious deficits in their quality of life (Patel & Agrawal, 2021). Factors contributing to this include exclusion from school or extracurricular activities, fear of therapeutic procedures, and the visibility of lesions. The number of lesions and associated symptoms such as pain, tenderness, and itching also play a role in affecting the child's well-being (Goldstein & Hsu, 2020; Moore & Williams, 2019).

The indications for treatment are multifaceted. Treatment is recommended when MC exacerbates atopic dermatitis, results in the child being excluded from school or activities, causes bullying, or leads to significant psychological distress (Thomas & Marks, 2018). Additionally, treatment is necessary when there are complications such as bacterial superinfection, cosmetically disfiguring lesions, prolonged illness, or severe itching. In cases where MC leads to quality-of-life impairment or poses a risk of spreading in children with immunosuppression, treatment

4. Epidemiology

becomes crucial to manage and mitigate these issues effectively (Wurster & Morrell, 2022; LaRochelle & Kerdel, 2017).

Available Treatment Options for Molluscum Contagiosum

Molluscum contagiosum (MC) is a viral skin infection caused by the Molluscum contagiosum virus (MCV), characterized by domeshaped papules on the skin (Figure 1). Treatment options for MC have evolved over time (Table 1), with various approaches focusing on physical removal or chemical destruction of lesions. However, these methods are not without limitations, and the search for a universally effective and safe antiviral treatment continues.

Curettage is a commonly used treatment method for MC. This procedure involves the mechanical removal of the lesions using a sharp instrument called a curette. One significant advantage of curettage is its ability to allow for histological examination of the tissue if a diagnosis is uncertain. To minimize discomfort, local anesthesia is often applied, typically in the form of EMLA cream, which contains a eutectic mixture of lidocaine and prilocaine. Although effective, curettage has its drawbacks. The requirement for local anesthesia, potential pain, bleeding, and the risk of scarring are notable concerns. Additionally, EMLA cream can cause localized purpuric reactions, and large-area application may lead to systemic toxicity (Gerlero & Hernández-Martín, 2018).

Cryotherapy is another method utilized to treat MC, involving the application of liquid nitrogen to freeze and destroy the lesions. The extreme cold induces the formation of intracellular and extracellular ice crystals, leading to cellular damage and the eventual destruction of the lesions. Cryotherapy typically requires one or two treatment cycles administered at intervals of one to three weeks. While this method is effective, it is often poorly tolerated by young children, who may experience significant discomfort. Potential side effects include blisters, scarring, and residual hyperpigmentation or hypopigmentation (Gerlero & Hernández-Martín, 2018).

Potassium Hydroxide (KOH) is a chemical treatment that works by dissolving keratin, the protein found in skin cells. KOH is applied directly to the lesions in aqueous solution, usually at concentrations ranging from 5% to 20%. Studies have shown that a 10% KOH solution can effectively clear lesions, with a study reporting complete clearance in 32 out of 35 children treated twice daily. However, KOH treatment can cause acute stinging and potential infection, leading to the discontinuation of treatment in some cases. Despite this, KOH is often preferred over cryotherapy due to its non-invasive nature and lower cost. Research comparing KOH with cryotherapy and other treatments has shown that KOH generally has a quicker onset of action and is as effective as other methods (Gerlero & Hernández-Martín, 2018).

Cidofovir, a broad-spectrum antiviral drug and dCMP analogue, has been used for treating MC, particularly in immunocompromised patients. It inhibits viral DNA polymerase, blocking viral replication. Cidofovir can be administered intravenously or topically, but it comes with potential side effects, including pain, erosion, inflammation, and nephrotoxicity. The high cost and potential adverse effects make it a less favorable option for routine use (Guan et al., 2014).

Cantharidin, a natural toxin derived from blister beetles, has been used since the 1950s for treating molluscum contagiosum (MC) and warts. As a topical keratolytic and vesicant agent, cantharidin induces acantholysis and intra-epidermal blistering within 24 to 48 hours. This process disrupts desmosomal attachments and facilitates the exfoliation of infected tissue. Despite its historical use, the efficacy of cantharidin in treating MC has been inconsistent. Notably, the US Food and Drug Administration (FDA) has not approved cantharidin for this purpose (Vakharia et al., 2018).

Nitric oxide (NO) has recently gained attention as a potential treatment due to advances in its delivery. NO, an endogenous molecule, acts as both an immune modulator and a broad-spectrum antimicrobial agent. It provides localized immunity by targeting foreign organisms directly. Historically, the development of topical NO treatments faced challenges related to its safe storage and delivery, but improvements in these areas have enhanced its potential as a treatment modality (Hebert AA et al., 2019).

Acyclovir, commonly used for viral infections, was examined in a case report involving a 50-year-old man with MC. The patient initially presented with a soft, non-tender lump that grew and became umbilicated. Despite the lesion's eventual resolution after self-treatment, additional MC-like lesions appeared. The diagnosis was confirmed by histology, and the lesions were removed entirely. Despite efforts to prevent self-inoculation, new lesions continued to appear for three months. However, after a course of 200 mg acyclovir tablets taken five times a day for five days, the lesions ceased recurring. This treatment was initiated following serology that excluded HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV) infection (Luigi Castelli, 2015).

Cidofovir, a nucleotide analogue of deoxycytidine monophosphate, is known for its antiviral properties, though its exact mechanism of action remains unclear. It inhibits viral DNA polymerase, thereby blocking viral DNA synthesis. Cidofovir can be administered either intravenously or topically. The intravenous regimen typically involves a dose of 5 mg/kg per week for two weeks, followed by a dose every two weeks. Topical application involves a 1%-3% cream or gel applied daily. While cidofovir has shown success in treating MC resistant to other therapies, its high cost and the need for further research on its efficacy and safety in children remain significant concerns (Gerlero & Hernández-Martín, 2018).

Treatment options for molluscum contagiosum include mechanical removal, cryotherapy, chemical agents like potassium hydroxide, and antiviral drugs. Each method has its advantages and limitations, and ongoing research aims to improve the effectiveness and safety



Figure 1. Molluscum contagiosum is characterized by small, raised lesions often with a central dimple (Singh & Whittam, 2021).

Topically	Topically	Destructive,	Immune	Homeopathic/	Other Treatments
Outpatient	Home	Outpatient	therapy	Natural	
Silver nitrate	Imiquimod	Cryotherapy	Cimetidine	Australian	Adhesive tape
	cream 5%			essential oil	
Trichloroacetic		Curettage	Cidofovir,		
acid	Benzoyl				Hyperthermia
	peroxide	Manual	Interferon		
Podofilin		extrusion		Tea tree oil	
	Hydrogen		Candidin		Wait and see
Cantharidin	peroxide	Carbon dioxide			
		laser			
Salicylic acid	Potassium				
	hydroxide	Pulsed dye			
		lasera			

 Table 1. Treatment Options for Molluscum Contagiosum

of these treatments. Despite the advancements, there is no single approved antiviral therapy specifically targeting MC, highlighting the need for continued exploration in this field.

7. FDA-Approved Treatment Options for Molluscum Contagiosum

Topical Berdazimer Gel (Zelsuvmi): The US Food and Drug Administration (FDA) has approved topical berdazimer gel (Zelsuvmi), 10.3%, for treating molluscum contagiosum in patients aged 1 year and older. This approval marks the introduction of the first novel drug specifically formulated for molluscum contagiosum. Notably, berdazimer gel is unique as it is the only topical treatment that can be applied by caregivers or patients themselves, without the need for a clinician's office visit. This makes it a convenient option for both pediatric and adult patients.

Topical Solution Ycanth (Cantharidin): The FDA has also approved Ycanth, a topical solution containing cantharidin, for the treatment of molluscum contagiosum in patients aged 2 years and older. Ycanth offers a targeted approach to managing this viral infection and is suitable for use in both adult and pediatric populations.

8. Discussion

Molluscum contagiosum (MC) is a common viral skin infection affecting children, with a notable prevalence of 2-8%. Although generally benign and self-limiting, MC often requires intervention due to potential complications such as scarring, social stigma, and psychological distress. The clinical presentation of MC as skincolored, dome-shaped papules, primarily on exposed skin, can significantly impact the quality of life for affected individuals.

Prevalence and Transmission MC primarily affects children between the ages of 2 and 5, with no gender-specific prevalence. The infection spreads through direct skin-to-skin contact, autoinoculation, and contaminated objects, including swimming pool environments. The varied seroprevalence across different regions highlights the influence of geographic and climatic factors on the infection rates. For example, higher prevalence rates are observed in warmer climates, reflecting the role of environmental conditions in transmission dynamics.

The lesions of MC are typically dome-shaped, with a characteristic central umbilication. While often asymptomatic, they can cause pruritus and social discomfort, leading to significant psychological and social implications for children. The necessity for treatment is driven by the potential for exacerbation of atopic dermatitis, social exclusion, and cosmetic concerns. Treatment is particularly indicated when MC results in severe symptoms, secondary bacterial infections, or substantial impact on quality of life.

Traditional treatments for MC include mechanical methods such as curettage and cryotherapy, which are effective but associated with discomfort, potential scarring, and varying degrees of patient tolerance. Chemical treatments like potassium hydroxide (KOH) offer a less invasive alternative but can cause acute irritation and may not be suitable for all patients.

Recent advancements have introduced FDA-approved treatments that address some of the limitations of traditional methods. Topical berdazimer gel (Zelsuvmi) and topical cantharidin solution (Ycanth) represent significant progress. Berdazimer gel, as the first FDA-approved treatment specifically formulated for MC, offers a convenient option for both patients and caregivers, reducing the need for clinical visits. Cantharidin, previously used but not officially approved, is now available in a regulated formulation, providing a targeted approach with a potentially lower side effect profile.

The evolution of MC treatments reflects an ongoing effort to balance efficacy with safety and patient comfort. The introduction of berdazimer gel and Ycanth marks a step forward in managing MC with more effective and patient-friendly options. However, further research is essential to optimize treatment protocols, address gaps in current therapies, and explore new treatment modalities. This continued investigation will help mitigate the limitations of existing treatments and improve outcomes for patients affected by molluscum contagiosum.

9. Conclusion

Molluscum contagiosum, a prevalent viral skin infection primarily affecting children, poses significant challenges due to its persistent and localized nature. The infection, while generally benign, can lead to complications such as discomfort, social stigma, and psychological distress, making effective treatment essential. Various treatment options are available, including mechanical removal, cryotherapy, chemical agents like potassium hydroxide, and antiviral drugs such as cidofovir. Despite these options, many treatments come with limitations and side effects.

Recent advancements have led to the FDA's approval of two novel treatments for molluscum contagiosum. Topical berdazimer gel (Zelsuvmi) represents the first specifically formulated drug for this infection, offering convenience as it can be applied by patients or caregivers at home. Additionally, the FDA-approved topical solution Ycanth (cantharidin) provides a targeted approach for managing molluscum contagiosum. These approved treatments signify progress in addressing the infection more effectively and improving patient outcomes, though ongoing research is necessary to refine and expand treatment options.

Author contributions

H.M.G. conceptualized and supervised the study. G.M.G. and S.I.E.S. contributed to the study design and data analysis. E.A.T. and M.D.H. assisted in writing sections of the manuscript and provided

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REVIEW

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Competing financial interests

The authors have no conflict of interest.

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