Acne Vulgaris in Children and Adolescents: What's the Cause and How to Combat It

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ABBREVIATIONS FDA, US Food and Drug Administration

KEYWORDS acne vulgaris; adolescence; benzoyl peroxide; isotretinoin; macrolides; retinoids; tetracyclines

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Introduction

Acne vulgaris is a chronic disease of the pilosebaceous unit of the skin, characterized by open or closed comedones and the development of inflammatory papules, pustules, or nodules.¹ Acne is one of the most common skin disorders in adolescents and young adults, affecting up to 87% of teenagers.² During the young adult years acne typically exhibits a male predominance, while postadolescent acne mainly affects females.³ Acne is not solely a disorder of adolescence, nevertheless overall incidence declines with increasing age and typically resolves by the third decade. Pediatric acne is acne that manifests prior to adolescence, classified into 4 main groups on the basis of age at symptom onset: neonatal acne, infantile acne, mid-childhood acne, and preadolescent acne (Table 1).² Although acne is not associated with mortality, complications such as hyperpigmentation and scarring may arise. Additionally, the negative psychosocial effects of having acne can be detrimental to our young patients, therefore appropriate care and treatment is vital.

Pediatric Acne Categorization and Pathogenesis

Acne vulgaris lesions can be either comedonal or papulopustular³:

- Comedonal lesions are milder in severity and characterized by closed comedones, or "whiteheads," or open comedones, also known as "blackheads." Comedonal lesions are noninflammatory and typically smaller than 5 mm.
- Papulopustular acne has a more inflamed presentation with relatively superficial papules or pustules, although still typically smaller than 5 mm.
- Nodular acne is a more severe variation of papulopustular acne with deep-seated, inflamed, and often tender, large papules or nodules.

Acne in young children is usually mild; however, as adolescence progresses it can vary greatly. Neonatal acne occurs anytime from birth to less than 6 weeks of age and affects an estimated 20% of newborns.² This is typically mild and self-limited and does not require treatment. Infantile acne begins around 6 weeks of age and can last up to a year or sometimes a bit longer. It is more common in males and may present with both inflammatory lesions and comedones. As with neonatal acne, most infantile acne is typically self-limited and not associated with underlying endocrine pathology. On the rare occasion that infantile or neonatal acne is severe or if the child has other potential signs of hormonal abnormality, clinicians should submit a referral to a pediatric endocrinologist for further work-up. Acne that occurs in children between the ages of 1 and 7 years is known as mid-childhood acne and is typically a sign of an endocrine abnormality.

In adults, several different host factors play a role in contributing to the pathogenesis of acne, which leads to lesion formation. The 4 main players associated with acnegenesis include hyperkeratinization of follicles, increased sebum production, *Cutibacterium acnes* bacteria, and inflammation.³ In children, particularly infants, transient increased physiologic concentrations of adrenal androgens may be the culprit.⁴ Because androgens stimulate the growth and secretory function of sebaceous glands, they increase sebum production and thus facilitate the development of acne.³ Infants

Table 1. Pediatric Acne Categorization ²			
Age of Onset	Acne Type		
Birth to ≤6 wk	Neonatal		
6 wk to ≤1 yr	Infantile		
1 yr to <7 yr	Mid-childhood		
≥7 to ≤12 yr or menarche in females	Preadolescent		
≥12 to ≤19 yr or after menarche in females	Adolescent		

experience what is known as "mini-puberty," which consists of activation of the hypothalamic-pituitarygonadal axis during the neonatal period, resulting in elevated gonadotropin and sex steroid levels during the first 3 to 6 months of life.⁵ This transient elevation in androgens allows for the maturation of sex organs, and in male infants results in the production of gonadal testosterone, which can contribute to acne formation. Once hormone levels normalize, infantile acne typically subsides. Mid-childhood acne is rare and usually due to an endocrine imbalance, as children at this age do not normally produce a significant number of androgens; these children warrant an endocrine work-up.

Treatment for Mild to Moderate Acne

The treatment of acne in children and young adults varies depending on age and presentation; however, there are no large randomized controlled trials or observational studies of acne treatment in infants and young children.⁶ The guidelines published by the American Academy of Dermatology offer evidence-based recommendations for patients aged 9 years or older¹; additionally, an expert panel convened by the American Acne and Rosacea Society developed

recommendations for the treatment of pediatric acne, which also encompasses younger patients.² Ultimately, the goal of treatment in pediatric acne is to mitigate as many age-appropriate pathogenic factors as possible by reducing sebum production, preventing the formation of microcomedones, suppressing *C acnes* bacteria, and minimizing inflammation to prevent scarring.²

Like the treatment of acne in adults, clinicians treat mild pediatric acne with topical medications (Table 2). Monotherapy with benzoyl peroxide or a topical retinoid is the recommended initial treatment of choice; if monotherapy is ineffective, consider combination therapy.² Other potential options include topical antibiotics in combination with benzoyl peroxide or topical dapsone.¹⁷

Benzoyl peroxide acts by killing the bacteria on the skin, stopping the production of sebum, and breaking down the outermost layer of the skin. It is an oxidizing agent that has potential to improve both inflammatory and noninflammatory acne lesions.⁷ Benzoyl peroxide is the most widely studied over-the-counter product and is one of the most versatile, safe, inexpensive, and effective acne therapies.² While benzoyl peroxide is available over the counter in various dosage forms including

Table 2. Topical Medications Used for Pediatric Acne Vulgaris ^{2,7}					
Category	Medication	Age per FDA Indication	Expert Panel Recommendation		
Topical retinoid	Adapalene	12 yr and older	May be used as monotherapy or in combination regimens for all types and severities of acne in children and adolescents of all ages		
	lazarotene	9 yr and older for lotion, 12 yr and older for all other dosage forms			
	Tretinoin	9 yr and older for lotion, 10 yr and older for 0.05% gel, 12 yr and older for all other dosage forms			
	Trifarotene	9 yr and older			
Antimicrobial	Benzoyl peroxide	Adolescents	Safe and effective as monotherapy or in combination for mild pediatric acne or in regimens for acne of all types		
	Clindamycin	12 yr and older	Monotherapy is not recommended, must be used in combination with benzoyl peroxide		
	Dapsone	9 yr and older for 7.5% gel, 12 yr and older for 5% gel	May be considered in pediatric acne		
Topical androgen receptor inhibitor	Clascoterone	12 yr and older	FDA approved after expert panel review; has been studied in children as young as 9 yr		

FDA, US Food and Drug Administration

creams, gels, washes, and foams and in concentrations ranging from 2.5% to 10%, washes should be avoided or used cautiously in children to prevent eye irritation or accidental ingestion.⁶ Concentration-dependent irritation, staining, and bleaching of fabric and hair is a limiting factor in treatment with benzoyl peroxide.¹

Topical retinoids work by normalizing follicular hyperkeratosis and preventing the formation of the microcomedo, the primary lesion of acne.² The 4 currently available topical retinoid therapies for acne vulgaris include adapalene, tazarotene, tretinoin, and trifarotene. The safety and efficacy of retinoids in pediatric patients ages 12 years and older has been well documented in the literature, and several retinoid formulations have been approved by the US Food and Drug Administration (FDA) for children as young as 9 years.^{2,7} Experts agree that topical retinoids may be used as monotherapy or in combination regimens for all types and severities of acne in children and adolescents of all ages.² As with most medications, the lowest strength should be trialed first. If used in combination, apply benzoyl peroxide and tretinoin at different times of the day to avoid oxidation or degradation of the tretinoin product. The most common adverse effects of retinoids include dryness, burning, stinging, and scaling.² Retinoids can also cause photosensitivity; thus, encourage the routine use of sunscreen in these patients to improve tolerability.

Topical antibiotics such as clindamycin and erythromycin have not been studied for the treatment of acne in children younger than 12 years; however, clinicians may use them in the pediatric population as an alternative to retinoids and benzoyl peroxide.² The guidelines discourage monotherapy with topical antibiotics owing to concerns for antibiotic resistance, so patients should always use them in combination with benzoyl peroxide. $^{1} \ \ \,$

Topical dapsone is an antimicrobial agent that shows modest to moderate efficacy, particularly in the reduction of inflammatory acne lesions.⁸ Dapsone is thought to possess both anti-inflammatory and antimicrobial properties. While efficacy and tolerability of dapsone is favorable in both males and females, a subgroup analysis has demonstrated superior efficacy in females.⁹ The exact mechanism behind this sex difference is not well understood; however, differences in skin surface pH, skin thickness, and sex hormones may play a role. Dapsone does have a formulation available that is FDA approved for patients aged 9 years and older, and the expert panel suggests that it may be considered secondarily in pediatric acne.²⁷

Treatment for Moderate to Severe Acne

Moderate pediatric acne is often initially treated with topical combinations including a retinoid and benzoyl peroxide and/or topical antibiotics; however, more severe acne typically requires addition of systemic therapy (Table 3).² Whenever topical or systemic antibiotics are used in acne, they should be combined with topical benzoyl peroxide to prevent antimicrobial resistance.⁶ Additionally, clascoterone is a novel, firstin-class topical androgen receptor inhibitor indicated for the treatment of acne vulgaris in individuals aged 12 years and older. Several clinical studies for clascoterone have included patients as young as 9 years and have demonstrated favorable safety and efficacy.¹⁰

Tetracycline antibiotics such as doxycycline and minocycline are first-line medications for the treatment of moderate to severe acne vulgaris¹; however, clinicians do not use them in children younger than 8 years owing

Iable 3. Systemic Medications Used for Pediatric Acne Vulgaris ^{2,4}						
Category	Medication	Age per FDA Indication	Expert Panel Recommendation			
Tetracycline antibiotic	Doxycycline	8 yr and older	Oral antibiotics are appropriate for moderate to severe inflammatory acne vulgaris at any age. Tetracycline antibiotics should not be used in children younger than 8 yr			
	Minocycline	9 yr and older				
	Sarecycline	9 yr and older				
Macrolide antibiotic	Azithromycin Erythromycin	Not FDA approved for acne but used in infants and children for other indications				
Oral retinoid	Oral isotretinoin	12 yr and older	Recommended for severe, scarring and/or refractory acne in adolescents and may be used in younger patients			
Combination oral contraceptives	Various estrogen/ progestin combinations	Females 14 yr and older or at least 2 yr after menarche	May be useful as second-line therapy in regimens of care in pubertal females with moderate to severe acne			

FDA, US Food and Drug Administration

to their propensity to stain the developing tooth enamel. Additionally, we do not typically use systemic antibiotics and topical antibiotics simultaneously in the treatment of acne. Sarecycline is a newer, narrow-spectrum tetracycline antibiotic indicated for inflammatory lesions of non-nodular moderate to severe acne vulgaris in patients 9 years of age and older.⁷ In patients younger than 8 years who require systemic antibiotic therapy for acne, macrolides such as azithromycin and erythromycin are the antibiotics of choice.² Educate young patients and their caregivers on potential side effects of systemic antibiotics and inform them that the typical duration of therapy is 3 months. Both tetracyclines and macrolides can cause gastrointestinal distress; tetracyclines are also known to cause photosensitivity.⁷

For severe, nodular acne and acne unresponsive to systemic antibiotics, oral isotretinoin is the recommended treatment; it tackles all 4 major factors in acne pathogenesis. Oral isotretinoin is the only medication that can permanently alter the natural course of acne vulgaris and has the potential to induce long-term remission.¹¹ While isotretinoin is not FDA approved for use in children younger than 12 years, the expert panel agrees that it may be used in younger patients with severe, refractory, and scarring acne.² The most common side effects include dry skin and mucous membranes, visual changes, and myalgias.² Isotretinoin is teratogenic and contraindicated in pregnancy,⁷ which may be pertinent in our older adolescent population.

Hormonal therapy with combination oral contraceptive medications may be a reasonable second-line therapeutic option for female patients with moderate to severe acne vulgaris. We do not typically use combined oral contraceptives in children younger than 14 years or within the first 2 years of starting menses.¹² Additionally, patients with select cardiovascular and gastrointestinal comorbidities are not good candidates for treatment with these medications.¹

Benzoyl Peroxide and Benzene— Where Are We

As I have noted above, benzoyl peroxide has been used for decades in the treatment of acne vulgaris, however recently there have been several reports which highlight potential safety concerns. Benzoyl peroxide, particularly when exposed to high temperatures, is known to degrade into benzene, a potent human carcinogen.¹² Aside from its use in the production of various chemicals, benzene may be found in natural sources as it is emitted as a vapor into the atmosphere by forest fires and volcanoes, and it is a natural part of crude oil, gasoline and cigarette smoke.¹³ Even low levels of exposure to benzene at 1 part per million (ppm) or less have been shown to increase the risk of hematotoxicity.¹⁴

In March of 2024, Valisure LLC, an independent testing laboratory filed a Citizen's Petition with the

FDA requesting a recall and suspension of the sale of products containing benzoyl peroxide.¹⁵ Valisure conducted a study of 66 benzoyl peroxide containing products incubated at 50°C for 18 days. Subsequently, any products that showed relatively high stability were placed in 70°C incubation for 18 days. While in 70°C is an elevated temperature, 50°C is within a reasonable expected range that the product could be exposed to during routine handling. Elevated concentrations of benzene were detected in the majority of the benzoyl peroxide products tested, most of which were well over the 2 ppm acceptable concentrations set by the FDA. These levels ranged from about 0.2 ppm in a handful of the more stable products to over 1600 ppm in some of the worst offenders. Their results showed that even the most stable benzoyl peroxide formulations still produced over 2 ppm of benzene when incubated at 70°C for 14 or 18 days. They also discovered that benzene could leak outside of unopened benzoyl peroxidecontaining acne treatment products at concerningly high levels.

A second group of researchers tested 111 different benbzoyl peroxide formulations shortly after taking them off the shelf. They noted that 34% of products tested contained benzene above the 2 ppm limit.¹⁶ They also examined the effects of sunlight on degradation of benzoyl peroxide and concluded that UV exposure at levels expected outdoors are another concerning mechanism for the formation of benzene and may be more rapid than heat exposure. Additionally, they conducted a cold incubation experiment which did confirm that cold storage may stabilize benzoyl peroxide formulations.

Given this emerging data, the American Acne and Rosacea Society put out a statement recognizing these concerns, however stated that until further guidance is put out by the FDA upon confirmation of the data, patients should work with their providers to determine the best course of action to take.¹⁷ They note that switching to another treatment may be an option for some, however there is no formal mandate to stop the use of benzoyl peroxide at this time. They also highlight the importance of following appropriate storage instructions, and directions for when to discard products. Additionally, storing benzoyl peroxide-containing products under refrigeration to reduce degradation, and replacing products every 3 months is recommended. At this point in time, benzoyl peroxide continues to be considered safe and effective by the FDA. Reassuringly, two recent studies published in the Journal of American Academy of Dermatology suggest that routine use of benzolyl peroxide-containing products for acne was not associated with meaningful risk of benzene in the blood or increased risk of cancer.18,19

While these initial reports of potential for high levels of benzene exposure should not be taken lightly, it is unclear if these findings have any clinically significant impact at this time. As we await official guidance from the FDA, patients should collaborate with their providers to assess what is right for them. At a minimum, it is reasonable to store benzoyl peroxide-containing products away from direct sunlight and heat, and when not in use, in a cool place or even the refrigerator.

Most recently following the receipt of third-party testing results submitted to the FDA regarding elevated benzene concentrations in select benzoyl peroxide containing acne products, the FDA initiated independent testing to validate these findings. While the FDA testing results indicated fewer products with benzene contamination as compared to the third-party findings, this did result in a small amount of voluntary recalls at the retail level.²⁰ On March 11, 2025, several manufacturers volunteered to recall six over-the-counter acne products that the FDA found to have elevated benzene concentrations. An additional manufacturer volunteered to recall its Zapzyt Acne Treatment Gel after an elevated benzene concentration was found during in-house testing. The retail-level recall calls on stores and online retailers to remove these products from their shelves, but the FDA has not recommended that consumers take any action at this time. Even with daily use of these products for decades, the risk of a person developing cancer because of exposure to benzene found in these products is very low. The FDA is continuing to monitor the issue of benzene contamination in drug products, any newly available information will be published as it emerges.

Conclusion

The appearance of acne can be very troublesome for our pediatric patients, therefore timely and effective treatment is of utmost importance. In pediatric acne, treatment selection is based on lesion severity, patient age, and patient preference. Infantile acne is typically mild; when treatment is necessary, topical monotherapy is first line. Children with mid-childhood acne should have a consultation with an endocrinologist, as this is typically due to a hormonal imbalance; several topical and systemic treatments may also be used, based on expert opinion. Severe acne in pediatric patients may require the use of systemic antibiotics or isotretinoin, although age does play a factor in medication selection. Hormonal therapies are another option for some of our adolescent female patients with acne, depending on their age and onset of puberty. Treatment for acne in preadolescents uses the same principles as we use for adolescents and adults, with the exceptions of some therapies such as tetracycline antibiotics and hormonal therapies. Recently, benzoyl peroxide, a common ingredient found in many topical acne products, was linked to potential benzene exposure. While this did result in a small retail-level recall, benzoyl peroxide still continues to be considered safe and effective by the FDA.

Article Information

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