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Review article

Understanding and Managing Acne Vulgaris: Causes, Symptoms, Types and Treatment Options

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ABSTRACT

Acne is a common skin condition that affects millions of individuals worldwide, causing physical and psychological distress. This article aims to provide an overview of the causes, symptoms, different types of acne and their respective treatments. The causes of acne vulgaris are multifactorial, involving an increase in sebum secretion, bacteria, inflammation, hormonal changes, androgens, genetics, diet, medicine, cosmetics, stress, environmental factors, and lifestyle factors. The types of acne discussed include non-inflammatory lesions, also called comedones, which include blackheads and whiteheads. Inflammatory lesions include pustules, papules, nodules, and cysts. Various treatment options, particularly topical and oral medications, are available for acne vulgaris. Topical treatments, such as benzoyl peroxide, salicylic acid, retinoids, and antibiotics, are commonly used for mild to moderate acne. For more severe cases, oral medications like antibiotics, isotretinoin, and hormonal therapy can be used. Hormonal therapy, such as a combination of oral contraceptives and anti-androgens, is recommended primarily for female patients. The effectiveness of each treatment method varies depending on the type and severity of acne, as well as individual patient factors such as skin type, age, hormonal status, and treatment tolerance. By understanding the distinct characteristics of each acne type and the available treatment options, healthcare professionals can make up-to-date decisions and tailor treatment plans to meet the specific needs of patients.

1. INTRODUCTION

Most people know acne vulgaris as "acne". Acne is ranked among the top ten most common diseases worldwide (Chilicka et al., 2023), affects three out of every four people globally (Parwez et al., 2023). Ranked as the eighth most prevalent disease, with an estimated 9.4% occurrence across all age groups. Acne vulgaris remains a leading reason for dermatology consultations (Chen et al., 2023). This chronic inflammatory skin condition can persist for months to decades, necessitating long-term, safe, and effective treatment. However, poor adherence, reported in 40–50% of treated patients, diminishes therapeutic outcomes (Kim and Ochsendorf, 2016). Untreated acne may lead to permanent scarring, post-inflammatory hyperpigmentation, or both (McNeil et al., 2023). Therefore, it is preferable to choose

treatments and procedures that increase adherence (Kim and Ochsendorf, 2016).

Acne affects individuals across all life stages and geographic regions, typically presenting as red bumps, blackheads and whiteheads on the face, back, shoulders and chest. Eight out of ten people between the ages of 11 and 30 experience acne at some stage throughout their teens. The condition of the skin defect might range from mild to severe. (Gupta et al., 1998). While not contagious, it impacts 85% of people at some point, commonly between ages 12 and 25, with peak prevalence during adolescence. (Khaleel, 2022). Approximately 40% of men and women report acne in their 20s, with 20% experiencing it into their 30s (Patel and Bhatia, 2021) and 5% beyond age 45 (Khaleel, 2022).

The word acne originates from a Greek word acme, which means "the highest point". The word was initially spelled incorrectly in 1835, with a "n" instead of a "m" (Jain et al., 2017; Yasin, 2015). Acne vulgaris is a prevalent chronic skin condition involving the pilosebaceous unit, which comprises the hair follicle and sebaceous gland (Greydanus et al., 2021). These units, concentrated on the face, neck, chest and back, produce sebum, an oily substance essential for skin and hair lubrication. Acne manifests as inflammatory or non-inflammatory lesions and shares pathophysiological features with other conditions like seborrheic dermatitis and folliculitis (Martel et al., 2017).

Sebum, composed primarily of triglycerides and free fatty acids (57.5%), wax esters (26%), squalene (12%) and cholesterol with its esters (4.5%), is transported through hair follicles to the skin surface. While essential for skin and hair hydration, UVB protection and antioxidant delivery, excessive sebum production can combine with dead skin cells and bacteria, clogging pores and contributing to acne development (Das & Reynolds, 2014).

Sebaceous glands are holocrine oil-producing glands located beneath the skin, connected to hair follicles. They secrete sebum, an oily substance that lubricates hair and skin while preventing dryness (Lavers, 2017). Sebaceous glands are most concentrated on the face, scalp, chest and back —the primary sites of acne formation—and are absent on the palms, soles and dorsum of the feet (Makrantonaki et al., 2011). Sebaceous glands are the largest and densest in the mid-back, forehead and chin, with densities reaching 400–900 glands/cm² (Van Onselen, 2011).

Keratin, produced by cells lining hair follicles (Rouse and Dyke, 2010), mixes with sebum and accumulates within the follicle, which also harbors bacteria and fungi (Witka et al., 2020). Open pores allow this mixture to flow out, but clogged pores caused by factors such as touching the skin, using makeup, or applying creams trap keratin and sebum inside (Bhadra and Atanu, 2020). This blockage leads to follicular swelling and as the follicle expands, small openings may form, allowing bacteria and debris to escape and triggering an inflammatory response (Plewig and Kligman, 2012). The buildup of keratin and sebum exacerbates inflammation, resulting in the red bumps and pimples characteristic of acne (Montagna, 2012; Sanghvi, 2022; Ravisankar et al., 2015).

Acne may appear as either inflammatory or non-inflammatory lesions or a combination of both (Alamdari et al., 2016). Its development is influenced by genetic predisposition, androgen-induced sebaceous gland activity, abnormal keratinization, Propionibacterium acnes (P. acnes) colonization and an aberrant immune-inflammatory response (Greydanus et al., 2021).

2. REASONS FOR ACNE

The following factors are anticipated to be significant contributors to acne formation (Clark, 2009). The various reasons for acne are shown in Figure 1.

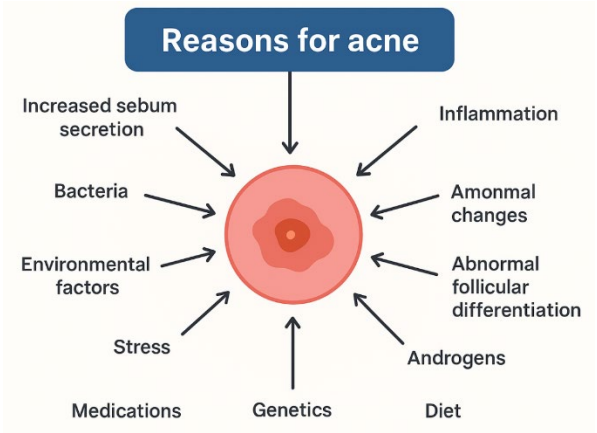

Figure 1: The various reasons for acne

2.1. Increased sebum secretion

The precise cause of excessive sebum production remains unclear, but it is linked to factors such as stress, high-glycemic diets, certain medications, environmental pollutants, genetics, hormones and other external influences. Sebum, produced by sebaceous glands, plays a central role in acne development as its overproduction can clog pores and contribute to acne formation (Fox et al., 2016).

2.2. Bacteria

P. acne is a gram-positive, slow-growing bacterium naturally present on healthy skin, living deep inside pores and follicles (McLaughlin et al., 2019); Kim 2005). P. acne is harmless in small amounts, but when it multiplies uncontrollably, it can cause acne (Perry and Lambert, 2011). P. acnes overgrowth can irritate the skin and cause inflammation, leading to blocked hair follicles and the formation of acne lesions such as pimples, blackheads and other types of acne lesions. Additionally, P. acnes releases chemicals that attract immune cells, triggering an inflammatory response responsible for red, swollen and painful acne (Mollerup et al., 2016).

2.3. Inflammation

Inflammation plays a key role in acne development. Excess oil production, combined with dead skin cells and debris, clogs pores, creating an environment for P. acnes growth (Pappas et al., 2009). This triggers the immune system, leading to the release of cytokines and chemokines that cause redness, swelling and pain. Ruptured hair follicles further intensify inflammation, resulting in papules and nodules. Reducing inflammation may help alleviate symptoms and prevent future outbreaks (Clark 2009).

2.4. Hormonal changes

Hormonal fluctuations, especially during puberty, are a major cause of acne. Increased androgen levels, such as testosterone, stimulate excess oil production, leading to clogged pores and the appearance of acne. Hormonal acne can also occur during menstrual cycles, pregnancy, menopause, or due to conditions like polycystic ovary syndrome (PCOS). Other hormones, such as insulin-like growth factor 1 (stimulating sebaceous glands) and cortisol (boosting sebum production), further contribute to acne. Hormonal acne typically manifests as deep, painful cysts or nodules on the chin, jawline and cheeks (Bhadra and Atanu, 2020).

2.5. Abnormal follicular differentiation (follicular hyperkeratosis)

Follicular hyperkeratosis occurs when excess keratin builds up in hair follicles, leading to clogged pores and white sebum plugs. This results in rough patches, small cone-shaped bumps resembling acne, which result in inflammation and redness. Commonly affected areas include the back of the upper arms, thighs and buttocks (Gollnick 2003).

2.6. Androgens

Elevated androgen levels are a key factor in acne development. Androgens are present in both males and females, but are higher in males. Androgen levels increase when a human becomes a teenage/adolescent (Handelsman, 2020). This rise enlarges sebaceous glands, triggering excess oil (sebum) production (Ambizas and Sousonis, 2016). Combined with dead skin cells, this clogs pores, leading to acne (Holschbach and Handa, 2017). Androgens also thicken skin, hindering dead cell removal and promoting lesion formation. (Mohiuddin, 2019). High androgen levels boost sebum and keratinocyte production, providing a favorable environment for P. acnes, which thrives on sebum (Clark 2009). This leads to microcomedones and, eventually, larger comedones due to sebum and keratinous material buildup (Tanghetti, 2013).

2.7. Genetics

Genetic predisposition plays a significant role in acne development by altering skin structure and function. Conditions like PCOS are associated with hormonal imbalances, including elevated androgen levels, which increase sebum production and clog pores, leading to acne. Similarly, genetic disorders like ichthyosis vulgaris can cause an accumulation of dead skin cells, promoting pore blockage and acne formation. Mutations in specific genes, such as those encoding filaggrin, a protein essential for maintaining the skin barrier, have also been linked to an increased susceptibility to acne (Common et al., 2019).

2.8. Diet

While diet is not the sole cause of acne, evidence suggests it can influence its development. Diets high in sugar, refined carbohydrates and unhealthy fats can elevate blood sugar levels, triggering systemic inflammation that contributes to acne (Spencer et al., 2009). Additionally, certain foods, such as dairy products, may affect hormone levels, promoting sebum production and acne formation. Although the relationship between diet and acne is complex and individualized, a balanced diet rich in whole, unprocessed foods and low in sugar may help reduce inflammation and support skin health (Spencer et al., 2009; Bowe et al., 2010).

2.9. Medications

Certain medications can induce or exacerbate acne as a side effect, primarily by altering hormone levels or increasing sebum production (Kazandjieva and Tsankov 2017). Below are some medications that can potentially cause acne.

2.9.1. Corticosteroids

Corticosteroids, often known as steroids, are widely used for their anti-inflammatory and immunosuppressive properties. Corticosteroids are used to treat conditions, including allergies, asthma, urticaria (hives), painful and inflamed joints, muscles, and tendons, lupus erythematosus, and skin conditions such as eczema and psoriasis. There are numerous ways to take corticosteroids, such as tablets, capsules, injections, inhalers, lotions, gels and creams (Lim and Bolster, 2019). However, corticosteroids may elevate androgen levels, stimulating sebaceous glands to overproduce sebum, which clogs pores and leads to acne formation. Additionally, corticosteroids can weaken the immune system and increase inflammation, further exacerbating acne (Elsaie, 2016).

2.9.2. Lithium

Lithium, commonly used to treat bipolar disorder, can induce acne in some individuals, though its exact mechanism remains unclear (Angelette et al., 2023). It is believed that lithium may increase sebum production and potentially alter hormone levels, thereby contributing to acne development (Rochowiak and Rybakowski, 2023).

2.10. Cosmetics

Cosmetics may contribute to the development of acne in several ways. Some cosmetics, especially those with oily or fatty bases, contain comedogenic substances that clog pores and promote acne (Aydemir, 2014). Harsh ingredients like alcohol or fragrances can cause skin inflammation, worsening existing acne (Chularojanamontri et al., 2014). Applying cosmetics with dirty hands or with a makeup brush or sponge that hasn't been cleaned properly can transfer bacteria and oils to the skin, potentially leading to the formation of acne (Ravisankar et al., 2015). Failing to remove makeup before bed can allow cosmetics to clog pores overnight, leading to the development of acne. Prolonged use of certain cosmetic ingredients may cause allergic reactions that result in acne (Conforti et al., 2021).

2.11. Stress

Stress can exacerbate existing acne and contribute to its development through the following mechanisms. Stress increases cortisol levels, which stimulates sebaceous glands to produce more oil, contributing to acne. Stress triggers an immune response that causes inflammation, worsening existing acne or promoting new breakouts. Stress may lead to behaviors such as skin picking or neglecting skincare, which can aggravate acne. Stress can disrupt sleep, impairing skin health and increasing systemic inflammation, both of which can worsen acne (Maleki and Khalid, 2018).

2.12. Environmental factors

Environmental factors can contribute to the development or exacerbation of acne through the following mechanisms.

2.12.1. Pollution

A survey of dermatologists conducted at an international dermatology conference in Beijing indicated that 67% of respondents believed that the prevalence of acne rises with pollution. While pollution does not directly cause acne, there are a number of ways that it can help the condition develop or worsen. Pollution may stimulate increased sebum production, leading to clogged pores and acne formation. Air pollution generates free radicals, which damage skin cells and promote inflammation, aggravating acne. Pollutants can irritate and inflame the skin, increasing susceptibility to acne-causing bacteria, particularly in individuals with sensitive or acne-prone skin. Pollution weakens the skin's natural barrier, reducing its ability to retain moisture and defend against irritants, exacerbating skin conditions like acne (Yang et al., 2020).

2.12.2. Humidity

High levels of humidity can increase sweat production, which can lead to clogged pores and acne. It's important to note that not everyone will get acne as a result of humidity, but under rare circumstances, humidity can contribute to the development of acne in the following ways. Sebum, skin-generated natural oil, can be created more readily in humid conditions. Excess sebum can clog pores, leading to acne. The growth of bacteria on the skin might be encouraged by humid conditions. When bacteria multiply, they can cause inflammation and infection, leading to acne. Humidity can make the skin wet and sticky, which can create friction and irritability. This can worsen existing acne, possibly resulting in new lesions. High humidity can make it difficult for sweat to evaporate, leading to an accumulation of sweat and dirt on the skin. If proper hygiene practices are not followed, this can lead to the development of acne (Krutmann et al., 2017).

2.12.3. Sun exposure

While moderate sun exposure may temporarily improve acne symptoms, excessive sun exposure can have adverse effects on the skin. Prolonged sun

exposure can stimulate excess sebum production, clogging pores and promoting acne formation. Additionally, it may dry out the skin, leading to irritation and inflammation, which further aggravates acne. Sun exposure can also cause hyperpigmentation, making acne scars and blemishes more prominent. These combined effects highlight the importance of balanced sun protection to manage acne and prevent further skin damage (Kim et al., 2023).

2.12.4. Chemicals

Exposure to certain chemicals in skincare, cosmetics, and household products can contribute to acne development through multiple mechanisms (Kim et al., 2023). Irritants in soaps, shampoos, or cleaning products can strip the skin of its natural oils, causing dryness and irritation that may lead to acne. Additionally, pore-clogging ingredients, such as oils and waxes in cosmetics or hair products, can block follicles, promoting acne formation. Some chemicals may also disrupt hormonal balance, exacerbating acne. For instance, pesticides and herbicides have been linked to hormonal imbalances that influence acne development. Understanding and minimizing exposure to these chemicals can aid in acne management (Kim et al., 2023).

2.12.5. Lifestyle factors

Lifestyle factors significantly influence acne development through various mechanisms. A diet rich in junk food, sweets and unhealthy fats can trigger systemic inflammation, increasing acne risk, while a nutrient-rich diet of fruits, vegetables and whole grains promotes clearer skin. Chronic stress elevates cortisol levels, exacerbating acne and inflammation. Poor sleep disrupts hormonal balance and heightens inflammation, both of which contribute to acne. A sedentary lifestyle may increase acne risk, whereas regular exercise helps reduce stress and inflammation, promoting skin health. Additionally, poor hygiene, such as infrequent face washing or wearing dirty clothing, can elevate the likelihood of acne. Adopting a balanced diet, stress management, adequate sleep, regular exercise and proper hygiene can collectively reduce acne risk (Say et al., 2021).

3. ACNE CLASSIFICATION BASED ON LESION

Based on lesion type and severity, acne is classified into mild (comedones), moderate (papules, pustules) and severe (nodules, cysts) (Chanda et al., 2013). Lesions are either non-inflammatory (blackheads, whiteheads) or inflammatory (pustules, papules, nodules, cysts), with inflammatory acne resulting from immune responses to infection (Rocha et al., 2014). Figure 2 shows the acne classification based on the lesion.

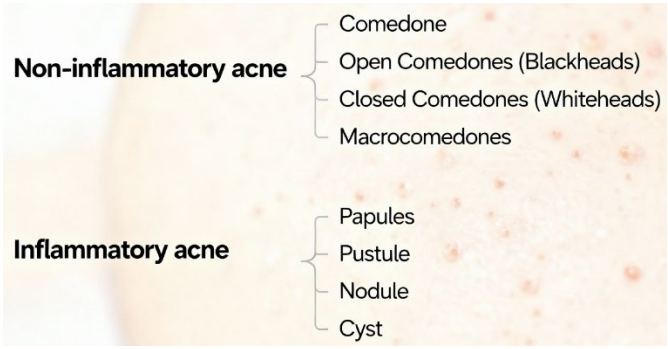

Figure 2: Acne classification based on lesions

3.1. Non-inflammatory acne

3.1.1. Comedone

Comedones are non-inflammatory acne lesions formed by the clogging of hair follicles with oil, dead skin cells and debris. They are classified as open comedones (blackheads) or closed comedones (whiteheads) and are commonly found on the face, chest and back. Treatment options include over-the-counter (OTC) topical medicines like salicylic acid (SCA) and benzoyl peroxide (BPO), as well as prescription treatments like retinoids and topical antibiotics.

3.1.2. Open Comedones (Blackheads)

Open comedones, or blackheads, are non-inflammatory lesions characterized by small, dark spots on the skin. They result from clogged hair follicles containing excess oil, dead skin cells and bacteria. The dark color is due to melanin in the skin reacting with oxygen upon exposure to air. Blackheads typically appear on the face, especially in the T-zone (forehead, nose, and chin), but can occur elsewhere on the body. Preventing blackheads involves regular cleansing with mild cleansers to remove excess oil and exfoliation to clear dead skin cells. Treatment options include topical agents like BPO or SCA to unclog pores, as well as professional procedures such as chemical peels, microdermabrasion, and extractions. Avoid squeezing or picking at blackheads to prevent inflammation and worsening of the condition.

3.1.3. Closed Comedones (Whiteheads)

Closed comedones, or whiteheads, form when pores are blocked by oil, dead skin cells and debris but remain covered by a thin layer of skin, preventing exposure to air and oxidation. They appear as small,

white or flesh-colored bumps and are most commonly found on the face, particularly in the T-zone (forehead, nose, and chin). Treatment options include topical agents such as BPO, SCA, or retinoids, which help open pores and prevent new whiteheads. Gentle exfoliation using mild scrubs or chemical exfoliants can also remove dead skin cells and reduce clogging. Dermatological procedures like chemical peels may be considered for more persistent cases. Picking or squeezing whiteheads should be avoided to prevent scarring, infection and exacerbation of acne (Suva et al., 2014).

3.1.4. Macrocomedones

Macrocomedones are enlarged acne lesions, measuring 2–3 mm or more in diameter, also referred to as giant comedones. They can be either open or closed and arise from the same factors as other acne types, including excess oil production, clogged pores, and bacterial overgrowth. Macrocomedones are more challenging to treat than smaller comedones and may be associated with certain conditions, such as keratosis pilaris atrophicans or folliculitis decalvans (Kaya et al., 2003). Both topical and systemic treatments are ineffective against macrocomedones (Bottomley and Cunliffe, 1993). Management typically involves professional extraction by a dermatologist using physical exfoliation techniques or laser therapy to reduce their size and appearance. Attempting self-extraction should be avoided to prevent scarring and skin damage (Thomson et al., 1999).

3.2. Inflammatory acne

3.2.1. Papules

Papules are small, raised, inflammatory acne lesions, typically less than one centimeter in size, ranging in color from flesh to red-brown or purple-brown. They commonly appear on the face, eyelids, trunk, and extremities. During the inflammatory response, bacteria release haemotoxic factors that attract neutrophils to the site of infection. These neutrophils release enzymes to combat the bacteria, but many also die in the process (Baughman and Valeyre, 2018). Treatment options include topical antibiotics (clindamycin, erythromycin and BPO) or oral antibiotics (doxycycline, azithromycin, or cephalexin) for bacterial causes, corticosteroids for psoriasis or eczema and OTC antihistamines (diphenhydramine, loratadine and cetirizine) for allergic reactions (Sanke et al., 2019).

3.2.2. Pustule

The papule changes its name to a pustule when dead neutrophils are present. Pustules are pus-filled papular lesions consisting of acute cells that are inflammatory. The pus typically consists of bacteria and neutrophils, although eosinophils or a mix of both may be present. These lesions are usually located in or just beneath the hair follicle. Pustules can result from acne, bacterial infections (e.g., impetigo), fungal infections (e.g., ringworm), or other skin irritations. Treatment depends on the underlying cause, with antibiotics for bacterial infections, antifungal medications for fungal infections, and anti-inflammatory drugs (oral or topical) to reduce inflammation (Fitzpatrick and High, 2017).

3.2.3. Nodule

Nodules form when bacteria, dead skin cells, and sebum accumulate in the dermal or subcutaneous follicles. These solid, elevated lesions, typically larger than 1 cm in diameter, are painful and can persist beneath the skin for extended periods. Nodules can be caused by bacterial infections, dermatitis, or other inflammatory skin conditions. Treatment varies based on the cause, with antibiotics for bacterial infections and corticosteroids for inflammatory conditions. Surgical intervention may be necessary for nodules that are cancerous or pose a risk of scarring. Nodules can spread or cause severe infections if ruptured or squeezed, leading to skin damage and scarring (Newman et al., 2011).

3.2.4. Cyst

Cystic acne, also known as nodulocystic acne, is a severe form of acne that leads to the formation of cysts. It develops from the accumulation of dead skin cells and oil in hair follicles, forming nodules and cysts (Vasam et al., 2023). Nodules and cysts are bigger than papules and pustules. Damages and rupture in the follicle wall release everything into the dermis. Here, even more neutrophils gathered and backup help from macrophages, lymphocytes, plasma cells, etc. This whole process is called inflammation. Therefore, we call it inflammatory acne (Plewig and Kligman, 2012).

Histamine and bradykinin, two substances released during the inflammatory process, will stimulate nerve endings in the skin, resulting in pain. They can become larger and deeper than other types of acne lesions, and can appear alone or in groups (Skidgel and Erdos, 2016). In addition to pain and discomfort, cystic acne can also cause scarring and emotional distress. Treatment typically includes topical retinoids, BPO, antibiotics and oral medications such as antibiotics, hormonal therapies, or isotretinoin. Severe cases may require drainage, laser therapy, or

chemical peels to reduce inflammation and scarring (Rumsfield et al., 1983).

3.3. Age-related acne

Acne can develop at any age, with its form and severity varying across the lifespan. Age-related acne is typically categorized into pediatric and adolescent acne. Pediatric acne affects children under 12 years, subdivided into neonatal (0-4 weeks), infantile (1-12 months), middle childhood (1-6 years), and preadolescent (7-11 years) acne. Adolescent acne occurs in individuals older than 12 years (Mancini et al., 2011).

3.3.1. Neonatal acne

Neonatal acne typically appears between 0 and 4 weeks of age, affecting approximately 20% of infants, with a five times higher prevalence in boys than girls. The condition is characterized by small closed comedones, primarily on the face (forehead, nose, and cheeks), and may also present erythematous papules, pustules, and cysts on the neck and upper body. Neonatal acne usually resolves naturally within 2 to 3 weeks, typically by the age of one month (Friedlander et al., 2011; Kim and Mancini, 2013; Maroñas and Krakowski, 2016).

3.3.2. Infantile acne

Infantile acne typically appears between 1 and 12 months of age, often due to hormonal changes and usually resolves on its own. More common in boys, lesions are primarily found on the face, including comedones, pustules, nodules, cysts, and scarring. The neck, back, and chest may also be affected. The condition usually lasts from one month to a year, with the most common onset between 3 and 6 months (Kim and Mancini, 2013; Maroñas and Krakowski, 2016).

3.3.3. Middle-childhood acne

Middle-childhood acne affects children aged 1 to 7 years. It is characterized by comedones, inflammatory papules, and pustules, primarily affecting the face, chest, and back (Maroñas and Krakowski, 2016).

3.3.4. Pre-adolescent acne

Pre-adolescent acne affects children aged 7 to 11, with girls experiencing more frequent and severe cases than boys. The condition commonly presents as comedonal lesions, including inflammatory papules, pustules, and nodules/cysts. Lesions are typically found on the midface, ears, chest, and back (Friedlander et al., 2011; Kim and Mancini, 2013; Maroñas and Krakowski, 2016).

3.3.5. Adolescent acne

Adolescent acne, the most common type, typically emerges during puberty due to increased androgen levels. It begins with non-inflammatory lesions like blackheads and whiteheads from ages 8 to 10, often affecting the T-zone, face, chest, and back. As the condition progresses, inflammatory lesions become more common, affecting areas like the cheeks, mouth, back, and chest. Girls tend to be affected earlier, with acne peaking in late adolescence and often persisting into the late 20s or early 30s (Basak and Zaenglein, 2013). A study by Ruchiatan et al., (2020) showed that both genders experience similar levels of adolescent acne vulgaris, with even mild cases often requiring treatment.

3.3.6. Acne in teens

Acne is most prevalent among teenagers and young adults, affecting 80% of individuals between the ages of 11 and 30. Girls typically experience acne most frequently between 14 and 17 years, while boys are most affected between 16 and 19 years. Acne often causes recurring outbreaks during adolescence, with symptoms typically improving as individuals age, and signs usually disappear by the early twenties (Preneau and Dreno, 2012).

3.3.7. Acne in adults

Acne can persist into adulthood or even develop later in life. Approximately 7–17% of individuals continue to experience acne at age 25, with 1% of men and 5% of women still affected at age 40. Adult acne is more common in women, with over 80% affected in early adulthood. Hormonal fluctuations, stress, and certain medications are often associated with adult-onset acne (Tan et al., 2018).

3.3.8. Menopausal acne

Menopausal acne arises during menopause due to hormonal fluctuations, particularly a decline in estrogen and progesterone, which increases androgen levels. This hormonal shift stimulates sebaceous glands, leading to excess oil production and acne development. Menopausal acne resembles adolescent acne, affecting the face, neck, chest, and back with blackheads, whiteheads, papules, pustules, and cysts. However, treatment can be more challenging due to increased skin sensitivity and dryness during menopause (Khunger and Mehrotra, 2019).

3.3.9. Acne in the elderly

Acne can affect individuals at any age, including those over 50, with a prevalence of up to 15% in this group. Contributing factors include hormonal changes, medication side effects, and skin irritation (Marks, 2004).

4. ACNE TREATMENT

Treatment options for acne vulgaris include topical and oral medications, as well as lifestyle modifications (Haider and Shaw, 2004). There are several types of medications used for acne treatment, including (Keri and Shiman, 2009):

i. Topical BPO: This drug eliminates acne-causing bacteria and lessens inflammation. It is often used in combination with other acne medications.

ii. Topical SCA: SCA is a beta-hydroxy acid that is commonly used in OTC acne treatments. It works by penetrating the pores and removing the skin's dead cells, oil, and other impurities that can clog pores and lead to acne. When applied topically, SCA can lessen acne-related irritation and redness, as well as prevent future breakouts. It is particularly effective for people with oily skin, as it helps to control excess oil production

iii. Topical retinoids: These medications are derivatives of vitamin A and work by preventing the formation of new acne lesions. Examples include tretinoin, adapalene and tazarotene.

iv. Topical antibiotics: These medications work by killing the bacteria that cause acne. Examples include clindamycin and erythromycin.

v. Oral antibiotics: These medications are prescribed for moderate to severe acne and work by destroying the acne-causing bacteria. Examples include doxycycline, minocycline and tetracycline.

vi. Oral contraceptives: These medications are prescribed for women with hormonal acne and work by regulating the hormones that cause acne.

vii. Isotretinoin: This medication is prescribed when previous therapies have failed to control severe acne. It functions by reducing sebum production.

4.1. Benzoyl Peroxide

BPO is an effective topical treatment for mild to moderate acne (Suva et al., 2014). targeting both inflammatory lesions and comedones (Agarwal and Agarwal, 2019). It helps to unclog pores and lessen the number of P. acne bacteria on the skin (Silverberg, 2023). BPO penetrates the stratum corneum region and reaches the pilosebaceous follicle. There, BPO quickly disintegrates into benzoic acid and hydrogen peroxide, resulting in the generation of free oxygen radicals that have a strong bacterial activity in the sebaceous follicles (Savage and Layton, 2010). Free radicals oxidize the proteins in the cell membranes, exerting a bacterial action (Tucker and Walton, 2007). BPO is mainly available as an OTC (Titus and Hodge, 2012) as well as prescription (Titus and Hodge, 2012; Tucker and Walton, 2007). It functions as a potent, broad-spectrum bactericidal agent through its oxidizing activity, (Dawson and Dellavalle, 2013) generating free oxygen radicals that disrupt bacterial cell membranes and kill P. acnes, a gram-positive anaerobic bacterium sensitive to oxygen (Savage and Layton, 2010). BPO has anti-microbial, anti-inflammatory, keratolytic and wound healing activities (Sagransky et al., 2009).

P. acne is a gram-positive anaerobic bacteria, (McLaughlin et al., 2019; Kim, 2005) The presence of oxygen is toxic to P. acne. Anaerobic bacteria are those that cannot survive or reproduce in the presence of oxygen (Noor and Khetarpal, 2024). BPO gradually liberates oxygen in the presence of water, which kills the P. acne (Chanda et al., 2013). It is recommended to start BPO with a lower concentration (2.5% or 5%) and gradually increase the strength if needed. BPO works best when used regularly; it may take several weeks to see an improvement in acne symptoms. Generally, depending on the conditions, applications may be made once or twice daily (Webster et al., 2002). There is no report of bacterial resistance to BPO (Kim and Ochsendorf, 2016). BPO can be used alone or in combination.

In clinical trials, BPO in combination with topical antibiotics proved 99.7% reduction in total P. acnes after 7 days of therapy (Kircik, 2013). Skin reactions such as skin dryness, peeling, or flaking; or redness or other irritation, itching, or tingly feeling, reddened skin, mild stinging or burning, may occur, especially at the start of treatment (Rathi, 2011). Irritation typically resolves with continued use. To prevent future irritability and harm to the skin, recommended to apply a mild moisturizer and sunscreen product. BPO may bleach clothing, bedding, towels and hair, so be sure to let it dry completely before coming into contact with any fabric (Baki, 2022). BPO and topical clindamycin are widely used together due to their synergistic effects in suppressing bacterial growth (Perche et al., 2023).

4.2. Salicylic acid (SCA)

SCA, a beta-hydroxy acid, is FDA-approved as an OTC treatment for mild acne at concentrations up to 2% (Labib et al., 2018). SCA successfully unclogs pores by penetrating congested ones and releasing a

mild acid that dissolves intercellular glue and breaks up the skin cells that line the pore, allowing for thorough cleaning of the skin. Due to its lipophilic nature, SCA demonstrates strong comedolytic activity, aiding in the removal of whiteheads and blackheads (Vedamurthy, 2004). Unlike benzoyl peroxide, SCA does not target P. acnes bacteria but focuses on exfoliation and pore-clearing. It is available in various formulations, including creams, gels, pads, lotions, and shampoos, at concentrations ranging from 0.5% to 3% (Titus and Hodge, 2012). Typically applied once or twice daily, SCA is well-tolerated, with potential side effects limited to mild dryness and irritation. Full therapeutic effects may take 4–6 months to manifest (Russell, 2000).

4.3. Topical Retinoid

Topical retinoids, such as tretinoin, adapalene, isotretinoin, motretinide, retinoyl-β-glucuronide and tazarotene (Dabade et al., 2011) are first-line treatments for mild to moderate acne, used alone or with benzoyl peroxide or antibiotics (Tuchayi et al., 2016). Neither tazarotene and isotretinoin is approved for acne treatment in the United Kingdom or the United States, respectively (Dawson and Dellavalle, 2013).

4.3.1 Tretinoin

Tretinoin, a vitamin A derivative and widely used topical retinoid, effectively treats mild to moderate acne, particularly non-inflammatory and inflammatory forms (Akhavan and Bershad, 2003; Russell, 2000). It promotes skin peeling, unclogs pores, and reduces blackheads, whiteheads, and inflammation, but does not completely cure acne (Yoham and Casadesus, 2020). Available in creams (0.025–0.1%), gels (0.025–0.01%), and liquids (0.05%), gel-based forms suit oily skin, while cream-based forms are ideal for dry skin (Feldman et al., 2004; Goodman, 1996).

All tretinoin formulations may cause irritation, with creams being the least irritating and least potent, while liquids are the most irritating and potent (Russell, 2000). A pea-sized amount is typically applied to the affected area once daily at bedtime to minimize photodegradation (Skinacea, 2012). Treatment begins with a low concentration, gradually increasing based on individual tolerance (Goodman, 1996). Initial use may worsen acne during the first 7–10 days (redness, scaling, and increased lesions), but improvements are expected with continued use. Optimal results may take 2–3 weeks, with full effects requiring up to six weeks (Yoham and Casadesus, 2020). Common side effects include burning, stinging, peeling, redness, and dryness, while rare effects include skin browning in treated areas.

4.3.2 Adapalene

Adapalene is a 3rd generation synthetic topical retinoid (Arooj et al., 2023; Vichare et al., 2023; Fathi et al., 2023) was FDA-approved in 1996 for acne treatment (Perche et al., 2023; McNeil et al., 2023). In 2016, 0.1% adapalene gel became available OTC, (Drake et al., 2022; Habeshian and Cohen, 2020) while 0.3% requires a prescription(McNeil et al., 2023). Adapalene effectively unclogs pores, treating blackheads and whiteheads, and its lipophilic properties enable rapid follicular penetration (Hazra, 2019). Depending upon the concentration, it is used to treat both mild to moderate and moderate to severe acne (Saleem et al., 2023). Its anti-inflammatory properties reduce redness and inflammation associated with acne (Biggs, 2023).

Adapalene may be useful in individuals who are struggling to tolerate tretinoin-induced irritability (Feldman et al., 2004). Adapalene is much milder than tretinoin and may cause less skin irritation (Chanda et al., 2013). Available in gel (0.1%, 0.3%), cream (0.1%), and lotion (0.1%) forms, (Kolli et al., 2019; Tolaymat et al., 2023), adapalene binds to retinoic acid nuclear receptors, normalizing follicular epithelial cell differentiation and reducing microcomedone formation (Jain and Ahmed, 2007). Typically applied once daily at bedtime (Cliff et al., 2023). According to Ioannides et al., (2002) study, 0.1% Adapalene gel was better tolerated than 0.05% isotretinoin gel over the course of 12 weeks of therapy.

4.3.3 Tazarotene

Tazarotene is a 3rd generation synthetic topical retinoid available with a prescription for acne treatment. It reduces sebum production, preventing pore blockage, and acts as a prodrug, converting into its active carboxylic acid form by quick de-esterification upon topical application (Gregoriou et al., 2014). Tazarotene normalizes keratinocyte differentiation, reduces keratinocyte proliferation, and lowers inflammatory marker expression (Zakaria et al., 2010). It is available in cream, gel, and foam formulations, typically applied once daily, preferably in the evening.

The US FDA approved tazarotene in gel form in 1997 (Gregoriou et al., 2014; Rosso and Tanghetti, 2013), cream form in 2001 (Vedamurthy, 2023) and foam form in 2012 for treating mild-to-moderately severe acne in 12-year-olds and older (Zakaria et al., 2010). The formulations are applied once daily,

improvement begins by week 4 and continues through week 12 (Khalil et al., 2017). Higher concentrations may cause more irritation than other retinoids (Guenther, 2003) making tazarotene a second-line treatment (Khalil et al., 2017). It is commonly used for patients unresponsive to tretinoin or adapalene (Feldman et al., 2004). The most common side effects of tazarotene in cream and gel 0.1% form are worsening of acne, increased sensitivity to sunlight, peeling, irritation, burning/stinging, scaling, dry skin, red skin and itching (Otlewska et al., 2020).

4.4. Topical Antibiotics

Topical antibiotics are commonly used to treat mild, moderate, and severe acne (Ly et al., 2023), by targeting acne-causing bacteria, reducing inflammation, and preventing new lesions (Nassar et al., 2023). Typically applied once or twice daily to affected areas, they are well-tolerated but may cause skin irritation or allergic reactions in some individuals (Russell, 2000). Treatment duration should not exceed 12 weeks to minimize bacterial resistance, and monotherapy or prolonged use is discouraged (Walsh et al., 2016). Erythromycin and clindamycin are the most prescribed agents, with over 30 years of use in acne management (Simonart and Dramaix, 2005).

4.4.1. Topical clindamycin

Clindamycin, a semi-synthetic derivative of lincomycin, is more lipophilic, allowing enhanced penetration into bacterial cells and improved efficacy against P. acnes (Dallo et al., 2023). It is prescribed for mild to moderate acne (Perche et al., 2023; Olisova and Anpilogova, 2023), reducing bacterial growth and inflammation (Gollnick, 2015). Available as gel, lotion, solution, or foam, clindamycin is often combined with agents like BPO (5% BPO/1% clindamycin) or tretinoin (1.2% clindamycin phosphate/0.025% tretinoin). Foam formulations release clindamycin phosphate faster but penetrate less than gel formulations (Abdulla and Shalita, 2009). Applied once or twice daily, adverse effects include dryness, redness, itching, or new blemishes (Sagar and Kumar, 2023). While effective for short-term monotherapy, clindamycin demonstrates enhanced efficacy in combination with retinoids like tretinoin, tazarotene, or adapalene (NilFroushzadeh et al., 2009).

4.4.2. Topical erythromycin

Erythromycin, a macrolide antibiotic, is commonly used topically to treat mild to moderate inflammatory acne vulgaris. It reduces P. acnes density and suppresses reactive oxygen species and neutrophil chemotactic factors, effectively resolving inflammatory lesions (Sayyafan et al., 2020). Available as a gel, solution, ointment, pledget (small pads soaked in medicated solution), or thin film, it is typically applied once or twice daily. Erythromycin 2% gel and solution significantly reduce both inflammatory and non-inflammatory lesions. Side effects include mild irritation, burning, redness, and dryness (Otlewska et al., 2020). Its low absorption makes it safe for use during pregnancy and breastfeeding. Visible improvement may take weeks to months, emphasizing the need for consistent use as directed (Ly et al., 2023).

4.5. Oral antibiotics

Oral antibiotics are frequently prescribed for moderate to severe inflammatory acne, particularly when topical treatments are ineffective or impractical for large surface areas (Farrah and Tan, 2016). The Global Alliance to improve outcomes in acne advises against using oral and topical antibiotics alone or together but recommends combining oral antibiotics with topical retinoids, BPO, or other agents. Treatment duration should be limited to 3–4 months to minimize antibiotic resistance and side effects (Walsh et al., 2016), with topical therapy maintained for long-term management after discontinuing oral antibiotics (Patel and Bhatia, 2021). Oral antibiotics primarily reduce bacterial populations in and around hair follicles, mitigate inflammatory chemicals from white blood cells, and decrease sebum free fatty acid levels, alleviating inflammation (Benner and Sammons, 2013). Commonly prescribed options include:

4.5.1. Oral tetracycline

Tetracycline, a broad-spectrum antibiotic, is a widely prescribed oral therapy for acne (Graber, 2021), typically administered at 1 g/day in two divided doses on an empty stomach. Its efficacy in acne treatment relies on both antibacterial and anti-inflammatory properties (Nelson and Levy, 2011). Tetracycline treats acne by inhibiting bacterial protein synthesis, blocking aminoacyl-tRNA attachment at the 30S ribosomal subunit, and reducing inflammation by targeting surface bacteria. (Sanshita et al., 2023). Tetracycline is contraindicated during pregnancy and in children due to the risk of tooth discoloration (Munir et al., 2023). Women of childbearing potential are advised to use contraception while on this medication (Hirsch et al., 2023).

4.5.2. Oral erythromycin

Oral erythromycin, a bacteriostatic antibiotic, is prescribed for moderate to severe inflammatory acne resistant to other treatments (Caux et al., 2023). It is

effective when taken with food (Bienenfeld et al., 2017) and serves as an alternative to tetracyclines in pregnancy (Tripathi et al., 2013). Erythromycin inhibits P. acnes growth by binding to the 50S ribosomal subunit, blocking peptide synthesis and reducing inflammation. Common side effects include nausea and gastrointestinal discomfort (Farzam et al., 2023).

4.5.3. Oral Minocycline

Oral minocycline, a second-generation semi-synthetic tetracycline (Suárez-Rivero et al., 2023), has been widely prescribed for inflammatory acne since the 1970s (Hess and Fagan, 2010). Due to its high lipophilicity (Maffeis and Veraldi, 2010) and effectiveness in moderate to severe papulopustular acne (Perche et al., 2023). It inhibits P. acnes protein synthesis, reducing bacterial growth, inflammation and sebum production, but does not address acne scarring (Garner et al., 2012). It is also combined with azelaic acid for nodular acne treatment (Daniele et al., 2023).

Extended-release minocycline (1 mg/kg/day) reduced inflammatory lesions by 43.1%–45.8% over 24 weeks, while 100 mg/day for three months achieved a 66.55% reduction in patients aged 12 and older (Martins et al., 2021). Notable adverse effects include drug-induced hyperpigmentation and black hairy tongue, as seen in a 60-year-old patient after four months of 100 mg/day, with improvements six weeks after discontinuation (Takata and Hirai, 2023). Long-term use, such as 22 years at 100 mg/day, has been linked to blue-gray nail bed hyperpigmentation (Varghese et al., 2023). Minocycline-related scleral discoloration and ocular hyperpigmentation are more common in elderly patients, highlighting age-related risks (Islam and Horn, 2023).

4.5.4. Oral Clindamycin

Oral Clindamycin, a third-line acne therapy, is considered safe during pregnancy and lactation (Ly et al., 2023). It is effective in treating pustular acne unresponsive to tetracycline (Guin, 1981) and demonstrates anti-inflammatory properties while reducing P. acnes (Pugashetti and Shinkai, 2013) and free fatty acids (Cunliffe et al., 1972). It inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit (Akhavan and Bershad, 2003). It appears more effective than erythromycin and tetracycline (Guay, 2007) but is rarely used due to significant side effects, including gut flora disruption, Clostridium difficile overgrowth, pseudomembranous colitis, and diarrhea (5–20% incidence) (Dréno et al., 2004).

4.5.5. Oral Doxycycline

Oral doxycycline, a tetracycline-class broad-spectrum antibiotic (Wang et al., 2023), is favored for moderate to severe inflammatory acne due to its antibacterial, anti-inflammatory, and antioxidant properties (Henehan et al., 2017). It targets bacterial ribosomes and exhibits reduced side effects compared to other tetracyclines (Wang et al., 2023). With an 18-hour half-life, a once-daily 100 mg dose is recommended for three months (Cunha et al., 1982). Prolonged use should be avoided to prevent bacterial resistance (Islam et al., 2023). Sadati et al., (2023) study confirmed doxycycline's efficacy in reducing inflammatory lesions and improving acne, particularly in patients aged 18 and older. Babaeinejad et al., found that a three-month course of 100 mg doxycycline is more effective for moderate acne in patients over 18 (Babaeinejad et al., 2011).

4.5.6. Oral Azithromycin

Azithromycin, a macrolide antibiotic with improved pharmacokinetics compared to erythromycin (Rajar et al., 2023). It is effective over P. acnes and well-tolerated for acne treatment (Ullah et al., 2014). A regimen of 500 mg taken three times weekly (preferably Monday, Wednesday, and Friday/Saturday) for 4-8 or 12 weeks (Woźniacka et al., 2022) with significant improvements noted within four weeks (Kapadia and Talib, 2004). Its long half-life (~68 hours) supports infrequent dosing and high patient compliance (Rajar et al., 2023; Kim et al., 2018). Safe for pregnant women, azithromycin shows no reported resistance in acne treatment (Kardeh et al., 2019). A study found that 250 mg taken three times weekly reduced inflammatory lesions by >80% in an average of 11.67 weeks (Fernandez, 2000), particularly benefiting patients under 18 (Babaeinejad et al., 2011).

4.5.7. Oral Isotretinoin

Oral isotretinoin, a first-generation synthetic retinoid approved by the FDA in 1982, is the preferred treatment for severe acne (nodules and cysts), due to its anti-inflammatory properties (Chu et al., 2021; Kutlu, 2020; Zhang et al., 2022), particularly in cases unresponsive to 12 weeks of oral antibiotics Alturki et al., 2023). Studies from Mehra et al., 2012 and Rao et al., 2014 demonstrated that low-dose isotretinoin (0.1–0.4 mg/kg/day) is an effective treatment for severe acne. It is also effective for moderate acne with recurrence or resistance to standard therapies. Typically administered at 0.3–0.5 mg/kg/day for six months, doses can be increased to 1 mg/kg/day for prolonged therapy to enhance efficacy (Ibrahim et al.,

2023). Isotretinoin significantly reduces sebum production (~90% in six weeks), suppresses P. acnes colonization, and exhibits anti-inflammatory properties (Zhang et al., 2022; Villani et al., 2022). The FDA's iPLEDGE program, initiated in 2006, aims to prevent fetal exposure to isotretinoin (Jones, 2007), given its significant teratogenic risks, including birth defects, pregnancy loss, and neonatal complications (Raine, 2023). Typical regimens involve 0.25 mg/kg/day for six months or 0.5–1 mg/kg/day for 4–6 months (Capitanio et al., 2009).

4.6. Hormonal therapy

Acne is influenced by hormonal changes during puberty, menstrual cycles, and other factors that alter pilosebaceous gland activity (Suva et al., 2014). Elevated androgen levels at puberty stimulate follicular gland growth and sebum production, while hormonal fluctuations during menstruation can worsen acne by increasing oil production and clogging pores (Gollnick et al., 1991). Hormonal therapies aim to regulate hormone levels and mitigate their skin-damaging effects. Common options include androgen receptor blockers, oral contraceptives, glucocorticoids and inhibitors of peripheral androgen metabolism (Ebede et al., 2009; Barros and Thiboutot, 2017):

4.6.1. Androgen receptor blockers

Anti-androgen therapy reduces sebum production by 12.5–65% by targeting androgen-metabolizing cells in the pilosebaceous unit, including follicular keratinocytes and sebocytes, inducing sebostasis (Zouboulis and Rabe, 2010). Androgen receptor blockers, such as spironolactone, cyproterone acetate and flutamide, inhibit androgen effects on sebaceous glands (Barros and Thiboutot, 2017). However, they may cause feminization in men and birth defects if used during pregnancy (Katsambas and Dessinioti, 2010).

4.6.2. Spironolactone

Spironolactone is a synthetic 17-lactone steroid (Sanjel and Zhang, 2022), inhibits androgen activity by binding to androgen receptors, reducing sebum secretion and preventing pore blockage (Mossman, 2006). Widely used off-label since 1980 for female acne, it mitigates androgen-driven sebum overproduction, a key factor in acne pathogenesis (Layton et al., 2017). Its use in male patients is not prescribed due to risks of gynecomastia, libido loss, and feminization (Charny et al., 2017).

Spironolactone reduces sebum production by inhibiting sebocyte division, achieving approximately 80% reduction and mitigating whiteheads, blackheads, and inflammatory lesions through pore unclogging. Effective for acne treatment at doses of 25–100 mg/day, higher doses (50–200 mg/day) may be used over three months for severe cases (Barros and Thiboutot, 2017). Use during pregnancy may result in birth defects in the newborn baby (Shaw, 1991). Therefore, it is crucial that individuals on spironolactone treatment should not plan for pregnancy (Dréno et al., 2013). Roberts et al study concluded that spironolactone's efficacy and safety as a long-term alternative to systemic antibiotics in adolescent females (Roberts et al., 2021).

4.6.3. Cyproterone acetate

Cyproterone acetate, an antiandrogen, is commonly prescribed for acne, (Casals et al., 2023) often in combination with estrogen in oral contraceptive pills (OCPs) to regulate hormones and counteract androgenic activity associated with acne (Carlborg, 1986). The recommended dose in combination with an estrogen component in OCPs is typically 2 mg/day (Barros and Thiboutot, 2017).

4.6.4. Flutamide

Flutamide a non-steroidal androgen antagonist (Pedro et al., 2018) discovered in 1967 and introduced for medical use in 1983, has been used since 1989 in the USA for the treatment of prostate cancer (Johnson and Sonthalia, 2018). It is primarily used for excess androgen-related conditions such as hirsutism (excessive hair growth) and androgenetic alopecia (male pattern baldness) in women (Ramos et al., 2023). It has also been studied off-label for acne vulgaris, (Trivedi et al., 2017) showing efficacy in mild to moderate cases, (Adalatkhah et al., 2011) with doses of 62.5–250 mg/day (Uslar et al., 2023). Flutamide is 80% more effective when combined with oral contraceptives (Ebede et al., 2009; Pazos et al., 1999). However, its use in the U.S. is limited due to the risk of hepatotoxicity (<0.18%), necessitating liver function monitoring during treatment (Barros and Thiboutot, 2017; Malešević et al., 2020). As a result, it is advised to do liver function tests on a monthly basis for the initial 4 months of treatment and periodically thereafter (Rosenthal et al., 1996). Flutamide is also contraindicated in pregnancy as it can cross the placental barrier and cause feminization of the male fetus (Gao and Mahto, 2016).

4.6.5. Oral contraceptives

Oral contraceptives, also known as birth control pills (Schrager et al., 2020), containing

synthetic estrogen and progestin, are effective in treating acne by regulating hormonal imbalances (Almazrouei et al., 2023), particularly elevated androgens, which drive sebum production and pore clogging (Jusuf et al., 2023). These hormones reduce androgen levels, decreasing sebum secretion and acne formation (Wan, 2015). While not all oral contraceptives are approved specifically for acne, formulations with progestins like norgestimate, drospirenone, or cyproterone acetate are commonly used and effective (Beylot et al., 1998).

4.6.6. Glucocorticoids

Glucocorticoids, such as cortisone and hydrocortisone, are not typically first-line treatments for acne but may be used in severe, inflamed cases resistant to other therapies. Their anti-inflammatory properties can reduce inflammation in acne lesions, with dermatologists often administering diluted glucocorticoids via injection directly into affected areas for short-term relief (Brown and Shalita, 1998; Ffrooz et al., 1995). Glucocorticoids are typically used for targeted injections in severe acne cases, not as systemic or long-term therapy. Prolonged use can lead to side effects such as skin thinning, increased infection risk, and hormonal imbalances (Wang et al., 2014). Corticosteroid-induced acne, first reported in the 1950s, can develop after topical, oral, intravenous, or inhaled corticosteroid use, with onset ranging from 2-4 weeks to several months (Thanh et al., 2011). Acne occurs in 0–29% of patients receiving corticosteroid treatment (Fardet et al., 2007).

5. CONCLUSION

Acne vulgaris is a common and complex skin condition that requires a comprehensive understanding for effective management. Understanding the different types of acne vulgaris, including non-inflammatory, inflammatory and nodulocystic acne, is essential for accurate diagnosis and appropriate treatment selection. Comedonal acne, characterized by non-inflammatory lesions, often responds well to topical retinoids and exfoliating agents. Inflammatory acne, which presents with red and swollen lesions, typically requires a combination of topical and oral medications, such as antibiotics and BPO. Nodulocystic acne, the most severe form, may necessitate systemic therapies such as isotretinoin or surgical interventions. Hormonal acne, associated with hormonal imbalances, often benefits from hormonal treatments such as oral contraceptives or anti-androgens. While treatment options for acne are plentiful, it is essential to consider individual patient factors, such as age, medical history and treatment preferences. Additionally, lifestyle modifications such as maintaining a proper skincare routine, managing stress levels and adopting a healthy diet can play a significant role in preventing and managing acne.

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Conflict of interest

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