

Innovative Approaches in Psoriasis Management: Integration of Novel Drug Delivery Systems, Herbal Medicine, and Lifestyle Modifications

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Abstract

Psoriasis, a complex inflammatory skin disorder, is characterized by rapid skin cell proliferation resulting in thick, red patches covered with silvery scales. This review explores the multidimensional approach to managing psoriasis, which encompasses current therapies such as systemic medications, topical treatments, and phototherapy, all known to have potential side effects. Recognizing the associated increased risk of comorbidities like psoriatic arthritis, anxiety, and cardiovascular diseases among others, this paper also delves into the promising role of herbal medicines which are gaining popularity due to their accessibility, cost-effectiveness, and potential efficacy. Additionally, it highlights the emerging advancements in novel drug delivery systems including liposomes, nanostructured lipid carriers, and microneedles, aimed at enhancing treatment efficacy through improved drug targeting and reduced side effects. This comprehensive review seeks to provide valuable insights for the development of safer and more effective therapeutic strategies, offering a beacon of hope for those afflicted by this chronic condition and guiding future research in the field.

Keywords: Psoriasis, novel drug delivery systems, liposomes, nanostructured lipid carriers, microneedles, herbal medicine, lifestyle modifications, biologic agents

Introduction

The term psoriasis is derived from the Greek word "psora," meaning "itch," and "sis," meaning "action," referring to the condition of itching. Psoriasis is a chronic, non-infectious inflammatory dermatitis marked by acute exanthematous plaques with adherent silvery scales. It is an organ-specific autoimmune syndrome triggered by the cellular immune system, characterized by redness, irritation, and blistering patches on the skin. Psoriasis cannot be transmitted from person to person but can occur in family members. (1-6)

Pathophysiology of Psoriasis

The exact cause of psoriasis is not fully understood, but two main hypotheses exist. One suggests psoriasis results from excessive growth and reproduction of skin cells, a problem rooted in the epidermis and keratinocytes. The other proposes psoriasis as an immune-mediated disorder, with the rapid skin cell reproduction secondary to immune system factors. Activated T cells migrate to the dermis, releasing cytokines like TNF- α , which cause inflammation and rapid skin cell production. Immunosuppressant medications can clear psoriasis plaques, supporting the immune-mediated hypothesis.

Types of Psoriasis

Single Plaque Psoriasis: Characterized by reddish or salmon-pink lesions with silvery scales. The lesions may vary in size and are often active at the edges.

Chronic Plaque Psoriasis: Typically occurs on the elbows, scalp, knees, lumbosacral area, and umbilicus. It involves well-defined red, scaly, and thickened areas, often appearing in response to pressure (Koebner phenomenon).

Inverse Psoriasis: A site-responsive form of vulgaris, characterized by glossy, red areas without scales, often in intertriginous regions.

Guttate Psoriasis: Common in children and adolescents, featuring small papules that may resolve within a few months.

Pustular Psoriasis: A severe condition with sterile pustules on painful red skin, often triggered by infections, medication withdrawal, or other factors.

Palmoplantar Pustulosis: Involves recurring inflammation with pustules on the palms and soles, commonly affecting women who smoke.

Erythroderma: Involves the entire skin, leading to hypothermia, hypoalbuminemia, and increased cardiac output.

Psoriatic Arthritis: Characterized by joint inflammation, morning stiffness, and potential nail involvement, affecting over 10% of psoriasis patients.

Etiology of Psoriasis

Immunological Factors: Psoriasis is an autoimmune disease where T cells attack skin cells, causing accelerated skin cell production and hyperproliferation.

Genetic Factors: Psoriasis has a genetic component, with increased frequency in first and second-generation family members. Over 60 chromosomal loci, including Psors1 on chromosome 6p21, have been linked to psoriatic susceptibility.

Environmental Factors: Factors like UV rays, mechanical injury, infections, chemicals, drugs, smoking, and stress can trigger psoriasis.

Epidemiology

Psoriasis affects approximately 2% of the population in the USA, with higher rates in the Faroe Islands. It is less common in certain ethnic groups, such as the Japanese and South American Indians. The condition has a bimodal age distribution, with peaks at ages 15-20 and 55-60. The prevalence varies by region and population demographics.

Current Psoriasis Treatments

Topical Treatments:

Corticosteroids: Anti-inflammatory drugs that slow skin cell growth.

Vitamin D Analogues: Synthetic vitamin D forms that regulate keratinocyte proliferation.

Retinoids: Vitamin A derivatives that normalize skin cell growth.

Calcineurin Inhibitors: Immunosuppressants that reduce inflammation.

Coal Tar: Inhibits DNA synthesis and modulates immune responses.

Roflumilast and Tapinarof: New steroid-free creams that reduce inflammation and plaque formation.

Salicylic Acid: A keratolytic agent that helps remove scales.

Phototherapy:

UVB Therapy: Uses UVB rays to treat psoriasis by altering immune cell activity.

PUVA Therapy: Combines psoralen with UVA rays to inhibit DNA synthesis and cell division.

Excimer Laser: Focused UVB light for small areas of psoriasis.

Sunlight: Natural exposure to UVA and UVB rays.

Systemic Treatments:

Methotrexate: Inhibits DNA synthesis and reduces cytokine production.

Cyclosporine: Suppresses T cell activity and cytokine production.

Acitretin: Modulates keratinocyte proliferation and cytokine expression. (7-15)

Other Treatment Approaches

Maintaining skin hydration, avoiding triggers, and following a healthy diet can help manage psoriasis. Identifying personal triggers, such as stress, infections, injuries, smoking, alcohol, certain foods, and weather changes, is crucial in preventing flare-ups. A balanced diet rich in fruits, vegetables, whole grains, lean proteins, and healthy fats can improve overall health and potentially alleviate psoriasis symptoms.

Herbal medicine has gained popularity among psoriasis patients due to its perceived safety, affordability, and effectiveness. Various plants and herbal formulations have shown promise in alleviating psoriasis symptoms.

Aloe Vera: Known for its soothing and anti-inflammatory properties, aloe vera can reduce redness and scaling associated with psoriasis.

Turmeric: Contains curcumin, which has anti-inflammatory and antioxidant properties, potentially reducing psoriatic inflammation.

Mahonia Aquifolium: An evergreen shrub, also known as Oregon grape, has antimicrobial and anti-inflammatory properties that may benefit psoriasis patients.

Capsaicin: Found in chili peppers, capsaicin can reduce the pain and inflammation of psoriasis when applied topically.

Tea Tree Oil: Possesses antiseptic and anti-inflammatory properties, which may help reduce scaling and inflammation.

Indigo Naturalis: A traditional Chinese medicine herb that has shown effectiveness in reducing psoriasis lesions. (16-26)

Lifestyle Modifications

Adopting a healthy lifestyle can significantly impact psoriasis management. Regular exercise, stress reduction techniques, and maintaining a healthy weight are essential components.

Exercise: Regular physical activity helps reduce inflammation and improves overall health, which can positively affect psoriasis symptoms.

Stress Reduction: Techniques such as yoga, meditation, and deep-breathing exercises can help manage stress, a known trigger for psoriasis flare-ups.

Healthy Diet: A diet rich in anti-inflammatory foods such as fruits, vegetables, whole grains, and lean proteins can help manage psoriasis. Omega-3 fatty acids, found in fish oil, have shown potential in reducing inflammation.

Emerging Therapies

Recent advancements in psoriasis treatment have led to the development of new therapeutic approaches, focusing on targeting specific pathways involved in the disease process.

Biologic Agents: These are proteins derived from living cells cultured in a laboratory. They target specific parts of the immune system, such as TNF- α , interleukins, and T cells, reducing inflammation and plaque formation.

Janus Kinase (JAK) Inhibitors: These small molecules inhibit the activity of JAK enzymes, involved in the immune response, providing a new approach to managing psoriasis.

Phosphodiesterase 4 (PDE4) Inhibitors: These inhibit the PDE4 enzyme, reducing inflammation and skin cell proliferation.

Apremilast: An oral PDE4 inhibitor that modulates the inflammatory response, showing effectiveness in reducing psoriasis symptoms.

Novel Drug Delivery Systems and Formulations in Psoriasis Treatment

Recent advancements in drug delivery systems and formulations have provided new opportunities for improving the efficacy and safety of psoriasis treatments. These innovative approaches focus on enhancing the delivery of active ingredients to the target site, minimizing side effects, and improving patient adherence.

1. Liposomal Drug Delivery

Liposomes are spherical vesicles composed of lipid bilayers that can encapsulate both hydrophilic and lipophilic drugs. They offer several advantages in psoriasis treatment, including:

Enhanced Penetration: Liposomes can penetrate the stratum corneum more effectively than traditional formulations, ensuring higher drug concentration at the target site.

Controlled Release: Liposomal formulations can provide a sustained release of the drug, reducing the frequency of application and improving patient compliance.

Reduced Toxicity: By encapsulating the drug within liposomes, systemic absorption is minimized, thereby reducing potential side effects.

2. Nanostructured Lipid Carriers (NLCs)

NLCs are a novel type of lipid nanoparticle that offer improved drug loading capacity and stability compared to traditional liposomes and solid lipid nanoparticles. They are particularly suitable for psoriasis treatment due to their:

High Drug Loading: NLCs can accommodate a higher amount of active ingredients, enhancing therapeutic efficacy.

Enhanced Skin Permeation: The small size and lipid composition of NLCs facilitate deeper penetration into the skin layers.

Biocompatibility: NLCs are made from biocompatible lipids, making them safe for long-term use.

3. Solid Lipid Nanoparticles (SLNs)

SLNs are submicron-sized particles made from solid lipids. They offer unique advantages for topical psoriasis treatment:

Sustained Release: SLNs can provide a controlled release of the drug, maintaining therapeutic levels for extended periods.

Occlusive Effect: The lipid nature of SLNs creates an occlusive barrier on the skin, enhancing hydration and drug penetration.

Reduced Irritation: SLNs minimize the risk of skin irritation by avoiding the use of harsh solvents.

4. Microneedles

Microneedle technology involves the use of tiny needles to create microchannels in the skin, facilitating the delivery of drugs directly into the dermis. This approach is particularly beneficial for psoriasis treatment due to:

Painless Application: Microneedles are minimally invasive and cause little to no pain compared to traditional needles.

Enhanced Absorption: By bypassing the stratum corneum, microneedles ensure better absorption and higher drug concentration at the target site.

Reduced Systemic Side Effects: Direct delivery into the skin reduces the likelihood of systemic absorption and associated side effects.

5. Hydrogels

Hydrogels are three-dimensional polymer networks that can retain a large amount of water. They are ideal for psoriasis treatment because they:

Provide Moisture: Hydrogels keep the skin hydrated, which is crucial for managing psoriasis symptoms.

Enhance Drug Penetration: The water content in hydrogels helps to soften the skin, allowing better penetration of active ingredients.

Prolong Drug Release: Hydrogels can be formulated to provide sustained release of the drug, reducing the frequency of application.

6. Microemulsions

Microemulsions are clear, thermodynamically stable mixtures of oil, water, and surfactants. They offer several advantages for psoriasis treatment:

Improved Solubility: Microemulsions can solubilize both hydrophilic and lipophilic drugs, enhancing their bioavailability.

Enhanced Penetration: The small droplet size of microemulsions facilitates better skin penetration and drug delivery.

Ease of Application: Microemulsions are easy to apply and spread evenly on the skin, improving patient compliance.

7. Transdermal Patches

Transdermal patches are adhesive patches that deliver drugs through the skin into the bloodstream. For psoriasis treatment, they offer:

Controlled Drug Release: Patches provide a steady release of the drug over a prolonged period, maintaining consistent therapeutic levels.

Improved Adherence: Patches are convenient and require less frequent application compared to topical creams or ointments.

Minimized Side Effects: By bypassing the gastrointestinal tract, transdermal patches reduce the risk of systemic side effects. (27-44)

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Conflict of Interest Declaration

The authors declare that there are no conflicts of interest regarding the publication of this article. All research was conducted independently, and there was no influence from any external parties that could have biased the results and conclusions presented in this review.

Conclusion

Psoriasis is a multifaceted chronic skin condition with significant physical and psychological impacts on affected individuals. Current treatments, while effective to varying degrees, often come with side effects and may not work for everyone. Integrating herbal medicine and lifestyle modifications has shown promise in providing additional relief, leveraging the natural anti-inflammatory and soothing properties of various plants and holistic health practices.

The advent of novel drug delivery systems, such as liposomes, nanostructured lipid carriers, solid lipid nanoparticles, microneedles, hydrogels, microemulsions, and transdermal patches, represents a significant leap forward in psoriasis treatment. These technologies enhance the delivery and efficacy of active ingredients, ensuring targeted action, reducing systemic absorption, and minimizing side effects. These innovations not only improve the therapeutic outcomes but also enhance patient compliance by offering more convenient and less invasive treatment options.

In summary, a comprehensive approach to psoriasis management that combines traditional therapies with herbal medicine, lifestyle changes, and advanced drug delivery systems holds great potential for achieving better control over the disease, improving patients' quality of life, and paving the way for more personalized and effective treatments. As research continues to advance, these integrated strategies will likely become central to the future of psoriasis care.

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