MEDS Chinese Medicine (2025)
Clausius Scientific Press, Canada

DOI: 10.23977/medcm.2025.070119
ISSN 2616-1753 Vol. 7 Num. 1

Research Progress on Androgenetic Alopecia in Traditional Chinese and Western Medicine

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Keywords: Androgenetic Alopecia; Integrated Chinese and Western Medicine Treatment; Acupuncture; Research Progress; Review

Abstract: Androgenetic Alopecia (AGA) has emerged as a prevalent condition that significantly impacts the aesthetic appearance of affected individuals. Due to its profound effect on personal appearance, patients often experience a diminished sense of self-esteem and may develop emotional issues such as anxiety and depression, which can adversely affect their social interactions. A variety of clinical treatments are available for this condition. This article aims to provide a comprehensive review of the pathogenesis of Androgenetic Alopecia from both Western and Traditional Chinese Medicine (TCM) perspectives. It will explore the efficacy of Western medical treatments, including pharmacological interventions, physical therapies, and surgical options, in conjunction with TCM's unique approaches such as oral and topical herbal remedies, acupuncture, and moxibustion. The goal is to offer insights that may inform clinical decision-making and provide a reference for the treatment of AGA.

1. Introduction

Androgenetic alopecia (AGA), also known as seborrheic alopecia, is one of the most common types of hair loss [1]. Clinically, it is primarily characterized by a gradual recession of the frontal hairline or thinning of hair on the crown. With societal development and the increasing pressures of modern life and work, hair loss has become a prevalent issue in China. Domestic studies have found that the prevalence of AGA is approximately 21.3% in men and 6.0% in women [2]. This condition significantly impacts aesthetic appearance, often leading to severe self-esteem issues, negative emotions [3], and even tendencies toward anxiety and depression [4]. The pathogenesis of AGA is complex, with current consensus suggesting that genetic factors, hormonal levels, environmental influences, and psychological stress play significant roles in its onset and progression [5, 6]. Currently, a variety of treatment methods for AGA are available, including pharmacological therapies, physical therapies, and surgical interventions. Pharmacological treatment is the most commonly used clinical approach, with finasteride and minoxidil being the two primary drugs approved by the FDA. Additionally, anti-androgen medications such as spironolactone and cyproterone acetate are often used for female patients. Physical therapies, such as low-level laser therapy (LLLT) and platelet-rich

plasma (PRP) injections, as well as surgical methods like hair transplantation and scalp micropigmentation, have also become focal points of research. In the field of Traditional Chinese Medicine (TCM), AGA is associated with deficiencies in the liver and kidney, internal damp-heat, and qi-blood deficiency. TCM emphasizes syndrome differentiation and treatment, with common methods including oral herbal medicine, topical herbal washes, and acupuncture. This article reviews conventional clinical treatment options and the latest research advancements in AGA, aiming to provide clinicians with valuable references and offer patients a broader range of therapeutic choices. In the future, with the continuous refinement of integrated Chinese and Western medicine strategies, the treatment of AGA is expected to become more diversified, personalized, and effective, helping more patients regain confidence and improve their quality of life.

2. Western medicine's understanding of androgenetic alopecia

2.1. Pathogenesis of Western medicine

The pathogenesis of AGA remains incompletely understood. Current research generally suggests that it is associated with the following factors：First, Oxidative Stress: Oxidative stress refers to an imbalance between the generation of free radicals and the body's antioxidant defense system. It may inhibit the remodeling process of hair follicles, accelerate follicular aging and degeneration, and promote the progression of AGA [7]. Secondly, androgens, especially testosterone, are at the core of AGA development. It is converted to DHT under the action of 5α-reductase. DHT binds to androgen receptors in hair follicles, ultimately leading to follicular miniaturization [8]. Thirdly, Psychological and Emotional Factors: Studies have found that 80. 0% of patients report that hair loss affects their quality of life, with some experiencing tendencies toward anxiety and depression. The severity of depressive symptoms has been correlated with the degree of hair loss [4]. last but not least, Ultraviolet (UV) Radiation: UV radiation may contribute to AGA by inducing perifollicular inflammation, promoting the aging of hair follicle stem cells and dermal papilla cells, and causing aging of dermal fibroblasts and an increase in elastic fibers, thereby facilitating the onset of AGA [9]. In addition to these factors, the pathogenesis of AGA may also involve genetics, diet, and microcirculatory disturbances. Future research is needed to further explore the interactions among these factors.

2.2. Western Medical Therapies

2.2.1. Pharmacological Therapy

(1) Minoxidil

Minoxidil is a potassium channel opener, and studies suggest that it may improve androgenetic alopecia by dilating blood vessels, increasing blood and oxygen supply to hair follicles, prolonging the anagen phase of hair growth, and activating follicular cells. Currently, minoxidil is available in two concentrations: 2% and 5%. For application, 1 ml should be evenly applied to areas of thinning hair and gently massaged for 3–5 minutes, with the total daily dosage not exceeding 2 ml. Research [10] indicates that the 5% concentration of minoxidil is more effective than the 2% concentration; however, the higher concentration is associated with increased scalp irritation. Common clinical adverse effects include mild dermatitis symptoms such as scalp itching, redness, or scaling, as well as hypertrichosis on the face.

(2) Finasteride

Finasteride works by selectively inhibiting type II 5α-reductase, thereby reducing the levels of dihydrotestosterone in both the serum and the scalp, which helps to slow down the process of follicular miniaturization. It is currently the only oral medication approved by the FDA for the

treatment of male androgenetic alopecia. The primary side effects of finasteride are related to male sexual function, including decreased libido and erectile dysfunction. However, these side effects typically resolve after discontinuation of the medication. Despite its efficacy, the use of finasteride in clinical practice is still subject to certain limitations.

(3) Ketoconazole

Ketoconazole is a broad-spectrum antifungal agent that can inhibit fungal infections and inflammatory reactions on the scalp, regulate sebum secretion, and improve the scalp microenvironment, thereby supporting follicular health. Additionally, it may indirectly promote hair growth by inhibiting the local production of dihydrotestosterone. Clinical studies have demonstrated that the topical application of 2% ketoconazole shampoo effectively alleviates scalp inflammation, promotes hair growth, and increases hair shaft diameter.

2.2.2. Physical therapy

(1) Low-Level Laser Therapy

Low-level laser therapy (LLLT) promotes tissue repair and hair growth by exposing tissues to low-energy light. Its mechanism of action is based on photobiomodulation (PBM), whereby light of specific wavelengths stimulates cellular activity, improves the follicular microenvironment, and thereby delays hair loss while promoting hair regeneration. In a study [11], 90 female patients with female pattern hair loss were randomly divided into three groups: the LLLT group, the 5% minoxidil group, and the combination therapy group. After six months of treatment, the results demonstrated that hair density and diameter significantly increased in all treatment groups compared to baseline. The LLLT group exhibited superior efficacy to the minoxidil-alone group, particularly in improving hair diameter. The combination therapy group showed the best performance in regulating scalp sebum secretion, outperforming both the LLLT and minoxidil-alone groups. No significant adverse effects were observed with LLLT, and patient tolerance was excellent. LLLT is typically administered using devices such as laser combs, laser caps, or laser helmets. The treatment frequency is 2–3 times per week, with each session lasting approximately 15–30 minutes. During the procedure, patients simply wear the device on their head, allowing the laser to evenly irradiate the scalp. The process is straightforward, painless, non-invasive, and associated with high patient compliance.

(2) Fractional laser therapy

Fractional laser technology involves the emission of laser beams with diameters of less than 500 micrometers, arranged in a fractional pattern to create thousands of uniformly distributed microscopic thermal injury zones in the epidermis and dermis, forming microtreatment zones [12]. The microscopic injuries, inflammatory responses, and enhanced delivery of auxiliary medications induced by fractional laser treatment can effectively promote hair growth [13]. During the procedure, patients typically experience tolerable pain and a sensation of warmth, which can be alleviated through the application of ice packs. Additionally, mild adverse reactions such as erythema, edema, pruritus, and post-inflammatory hyperpigmentation may occur, but these are generally within acceptable limits. It is important to note that improper use of high-energy parameters may lead to ulceration and scar formation. Furthermore, fractional laser therapy is not suitable for all patients with hair loss; caution is advised for individuals with active infections, severe keloid tendencies, or immune system abnormalities. Therefore, careful selection of appropriate patient populations is essential in clinical applications.

2.2.3. Other therapies

Currently, Western medicine offers a diverse array of treatments for androgenetic alopecia (AGA), including hair transplantation, platelet-rich plasma (PRP) therapy, botulinum toxin injections, scalp

micropigmentation, and emerging therapies such as stem cell therapy. From traditional pharmacological treatments to advanced stem cell-based approaches, each method possesses unique advantages and specific indications. In clinical practice, physicians can tailor single or combination therapies based on individual patient conditions to achieve optimal outcomes. In the future, with continuous advancements in medical technology, more innovative treatment modalities are expected to emerge, providing patients with hair loss more effective and personalized therapeutic options.

3. Traditional Chinese medicine understanding of androgenetic alopecia

3.1. Etiology and Pathogenesis in Traditional Chinese Medicine (TCM)

The Huangdi Neijing is the earliest ancient text to document "hair loss". Androgenetic alopecia (AGA) is a type of hair loss, and in Traditional Chinese Medicine, hair loss is primarily associated with the liver, spleen, and kidneys. The Influence of the Kidneys on Hair: The Suwen Shanggu Tianzhen Lun (Plain Questions On the Innate Vitality in Ancient Times) states that the growth of hair in both men and women is related to the abundance or decline of kidney qi. The kidneys store essence, and essence and blood share a common origin, mutually nourishing each other. If there is congenital weakness or deficiency of kidney essence, the hair cannot be adequately nourished, leading to sparse or unhealthy hair. The Influence of the Liver on Hair: The liver regulates blood and shares a common origin with the kidneys. The Liver Meridian of Foot Jueyin intersects with the Governor Vessel in the head and face, providing a pathway for the circulation of qi and blood. Therefore, when liver qi is harmonized, qi and blood can be properly distributed to nourish the hair. The Influence of the Spleen on Hair: The spleen governs transportation and transformation, and the spleen and stomach are responsible for digestion and absorption. Changes in dietary habits, such as dietary preferences or overeating, can burden the spleen and stomach, leading to internal damp-heat. When damp-heat rises to the head, it can cause hair loss. Thus, dysfunction in any of these organs can affect hair growth. Additionally, TCM holds that "hair is the surplus of blood". Insufficient qi and blood [14] or obstruction of the collaterals [15] can also contribute to androgenetic alopecia.

3.2. TCM syndrome differentiation and treatment

In modern medicine, the treatment of hair loss often focuses on the liver, spleen, and kidneys. The pathological nature of hair loss is characterized by a deficiency in the root and excess in the manifestation, with the syndrome evolution displaying dynamic developmental characteristics. Studies [16] have revealed that the syndrome differentiation primarily includes spleen-stomach damp-heat syndrome, liver-kidney deficiency syndrome, and blood-heat wind-dryness syndrome. Numerous modern TCM practitioners [17-20] advocate treating hair loss by addressing the liver, spleen, and kidneys. In the early stages, the emphasis is on clearing heat and draining dampness, as well as cooling the blood and promoting hair growth. In the middle stages, the focus shifts to soothing the liver and strengthening the spleen, as well as nourishing the blood and promoting hair growth. In the later stages, the treatment prioritizes tonifying the liver and kidneys, replenishing essence to promote hair growth or moving qi and resolving stasis, as well as activating blood to promote hair growth. For the treatment of spleen-stomach damp-heat type hair loss, effective formulations include Qushi Shengfa Tang [21] and Fangfeng Tongsheng San [22], both of which have demonstrated significant clinical efficacy and are worthy of application. For the treatment of liver-kidney deficiency type hair loss, effective formulations include Bushen Shengfa Tang [23] and Qibao Meiran Dan [24]. Wang Qinghua's research [25] analyzed the core components of oral medications for treating hair loss. The internal use of Polygonum multiflorum, Rehmannia glutinosa, Ligustrum lucidum, and Eclipta prostrata can nourish the liver and kidneys and promote the growth of dark hair.

These are often combined with Angelica sinensis and Rehmannia glutinosa to supplement qi and blood, while Poria cocos and Alisma orientale help to drain dampness and turbidity. The combination of these herbs collectively exerts the effects of nourishing essence and blood, promoting hair growth, and preventing hair loss. For external use, Platycladus orientalis, Sophora flavescens, Speranskia tuberculata, Polygonum multiflorum, Angelica dahurica, Dictamnus dasycarpus, Salvia miltiorrhiza, and Carthamus tinctorius are employed. These aim to cool the blood and clear heat, as well as unblock meridians to promote the growth of dark hair. Kong Jingjing's research [26] further confirmed the importance of Polygonum multiflorum, Angelica sinensis, Poria cocos, Dictamnus dasycarpus, Eclipta prostrata, Ligustrum lucidum, Morus alba, Moutan cortex, Rehmannia glutinosa, Rehmannia glutinosa, Cuscuta chinensis, and Platycladus orientalis. The study by Xiang Jing et al. [27] demonstrated that the oral administration of a self-formulated Tougu Cebai Fang (containing Speranskia tuberculata, Platycladus orientalis, Rubus chingii, Lycium barbarum, Artemisia capillaris, and other herbs) in the treatment of androgenetic alopecia (AGA) showed significant efficacy and is worthy of widespread application.

3.3. Acupuncture Therapy

3.3.1. Acupuncture

Acupuncture therapy, with its unique ability to regulate the viscera, unblock meridians, and harmonize qi and blood, has demonstrated significant effects in improving the scalp environment and promoting follicular recovery. Western medical research has revealed that acupuncture therapy treats AGA through mechanisms such as regulating androgen levels [28], improving trace element levels [29], and enhancing scalp blood circulation [30]. Under the guidance of the TCM theory of Xuanfu, Ding Dingming [31] employed filiform needle acupuncture combined with plum-blossom needle therapy in the initial stage. Acupoints such as Fengchi (GB 20), Fengshi (GB 31), and Fengmen (BL 12) were selected to promote qi and activate blood and dispel wind to unblock collaterals. In the middle stage, acupoints such as Taibai (SP 3), Taichong (LR 3), and Yanglingquan (GB 34) were used to soothe the liver and strengthen the spleen and regulate qi movement. In the later stage, acupoints such as Ganshu (BL 18), Shenshu (BL 23), Taixi (KI 3), and Xuehai (SP 10) were selected to warm the meridians and unblock collaterals and tonify the liver and kidneys.

3.3.2. Plum Blossom Acupuncture Therapy

The therapeutic principle of plum-blossom needle therapy lies in stimulating the skin without damaging the muscles, aiming to unblock meridians, regulate visceral functions, expel pathogenic factors, and support healthy qi, thereby achieving therapeutic and preventive effects. This therapy activates the meridians, regulates qi and blood in the viscera, and promotes local blood circulation. Zhang Yanan et al. [32] conducted a study in which 60 male patients with AGA were randomly divided into two groups. The control group applied a self-made hair growth tincture followed by minoxidil tincture daily, while the observation group received additional plum-blossom needle tapping on the scalp in conjunction with the control group's treatment. The treatment lasted for 12 weeks. The results showed a statistically significant difference between the two groups ($P<0.05$), indicating that plum-blossom needle tapping as an adjunctive therapy for male AGA can improve clinical symptoms and is associated with fewer adverse reactions. Ruan Ling [33] conducted a study in which 64 patients with androgenetic alopecia (AGA) were randomly divided into an observation group and a control group, with 32 patients in each group. Both groups were treated with 2% minoxidil tincture, while the observation group additionally received plum-blossom needle therapy combined with a traditional Chinese herbal hair growth solution. After six months of treatment, both

groups showed reductions in Sinclair Scale scores, psychological state scores, and vellus hair ratios, with the observation group demonstrating significantly greater reductions compared to the control group (P<0.05). Additionally, both groups exhibited increases in total hair count and hair density, with the observation group showing greater improvements than the control group (P<0.05). Xiao Xinran's study [34] found that cutaneous needle therapy for AGA due to liver-kidney deficiency (gan shen bu zu) demonstrated clinical efficacy comparable to conventional acupuncture therapy. Moreover, cutaneous needle therapy outperformed conventional acupuncture in improving clinical symptoms and increasing scalp temperature, potentially by enhancing scalp microcirculation to alleviate clinical manifestations.

3.3.3. Rolling Needle Therapy

Ouyang Lin [35] observed that rolling needle therapy combined with a self-formulated hair growth tincture significantly improved the efficacy of treating seborrheic alopecia after 12 weeks of treatment, with high safety. Jiang Zhuqian [36] divided 92 patients into an observation group (47 cases) and a control group (45 cases). The observation group was treated with oral Chinese herbal medicine combined with rolling needle therapy, while the control group received finasteride combined with minoxidil tincture. After three months of treatment, the total effective rate in the observation group was 87.23%, compared to 62.22% in the control group. The combination of oral Chinese herbal medicine and rolling needle therapy demonstrated significant efficacy and high safety in treating androgenetic alopecia due to spleen-stomach damp-heat, making it worthy of widespread application. Ruan Ling [33] conducted a study in which 64 patients with androgenetic alopecia (AGA) were randomly divided into an observation group and a control group, with 32 patients in each group. Both groups were treated with 2% minoxidil tincture, while the observation group additionally received plum-blossom needle therapy combined with a traditional Chinese herbal hair growth solution. After six months of treatment, both groups showed reductions in Sinclair Scale scores, psychological state scores, and vellus hair ratios, with the observation group demonstrating significantly greater reductions compared to the control group (P<0.05). Additionally, both groups exhibited increases in total hair count and hair density, with the observation group showing greater improvements than the control group (P<0.05). Xiao Xinran's study [34] found that cutaneous needle therapy for AGA due to liver-kidney deficiency (gan shen bu zu) demonstrated clinical efficacy comparable to conventional acupuncture therapy. Moreover, cutaneous needle therapy outperformed conventional acupuncture in improving clinical symptoms and increasing scalp temperature, potentially by enhancing scalp microcirculation to alleviate clinical manifestations.

3.3.4. Fire acupuncture

The Spiritual Pivot Official Needling states: "Cui needling, using a heated needle to treat bi syndrome. " This therapeutic method, which involves heating the tip of a filiform needle or three-edged needle until it is red-hot and then quickly inserting it into acupoints or affected areas, is known as fire needle therapy. Yang Xianlu's study [37] divided patients with (AGA) into a control group and an observation group. The observation group received fire needle therapy in addition to minoxidil tincture, while the control group used only minoxidil tincture. After 24 weeks of treatment, the effective rates in the observation group and the control group were 87.3% and 55.1%, respectively, with a statistically significant difference between the two groups (P<0.05). Furthermore, no severe adverse reactions were observed in either group after treatment. This indicates that fire needle therapy combined with minoxidil tincture can achieve favorable therapeutic outcomes for AGA, demonstrating high clinical application value and safety.

4. Conclusion

In summary, Western medicine generally attributes AGA to factors such as genetics, hormonal levels, environmental influences, and psychological stress. Treatment approaches include pharmacological therapies, physical therapies such as LLLT and PRP injections, as well as surgical methods like hair transplantation and scalp micropigmentation. TCM associates hair loss with liver-kidney deficiency, qi and blood deficiency and internal damp-heat. Treatment is often based on syndrome differentiation focusing on the liver, spleen, and kidneys. Common methods include oral and topical herbal medicines, acupuncture, and moxibustion. In the future, TCM should continue to integrate with modern medicine, conducting more in-depth scientific research to explore molecular mechanisms and therapeutic targets. Large-scale clinical trials are needed to further validate the efficacy and safety of these treatments.

Acknowledgement

Alopecia Using Tanshinone Capsules Combined with Touzao Formula Based on the "Damp-Heat and Blood Stasis" Theory. Shaanxi Provincial Hospital of Traditional Chinese Medicine, N.O. 2023-YBSF-321.

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