

Effectiveness of Autologous Platelet-Rich Plasma for Androgenetic Alopecia: A Double-Center, Non-Controlled, Randomized Clinical Study in Vietnam

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Purpose: This study aimed to evaluate the efficacy and safety of platelet-rich plasma (PRP) therapy in treating androgenetic alopecia (AGA) in Vietnamese patients.

Patients and Methods: A prospective, non-controlled clinical study was conducted on 41 patients (17 men and 24 women) diagnosed with AGA. PRP was prepared using a standardized double-spin centrifugation protocol and injected subdermally at affected scalp areas. Patients underwent three PRP sessions at four-week intervals.

Results: PRP treatment significantly increased hair density from 40.76 ± 14.26 hairs/cm² at T0 to 66.00 ± 18.00 hairs/cm² at T3 ($p < 0.05$). The percentage of patients with a positive hair pull test decreased from 75.6% (T0) to 12.2% (T3) ($p < 0.05$). A moderate positive correlation was observed between platelet concentration and hair density improvement ($\rho = 0.455$, $p < 0.001$). Patient satisfaction was high, 97.6% satisfied and very satisfied, and only mild, transient adverse effects were noted.

Conclusion: PRP is an effective and well-tolerated therapy for AGA, significantly improving hair density and reducing hair shedding.

Keywords: regenerative therapy, hair loss, PRP injection, treatment results

Introduction

Hair loss, or alopecia, is characterized by the absence or loss of hair in areas where it is typically present. This condition can be either localized or widespread or temporary or permanent. It affects individuals of all ages and occurs in both men and women. Alopecia is broadly classified into scarring and non-scarring types, with non-scarring alopecia being more common.^{1,2} Non-scarring alopecia includes conditions such as androgenetic alopecia, female pattern hair loss, alopecia areata, telogen effluvium, and anagen effluvium. AGA is the most prevalent cause of non-scarring hair loss, affecting up to 80% of men and over 40% of women, depending on the population studied.^{3–5} Although AGA is a benign dermatological condition and not physically harmful or life-threatening, it can significantly impact self-esteem and confidence. The psychosocial effects of AGA can be profound, potentially leading to anxiety or depression and severely affecting quality of life and social interactions.^{6–8}

AGA is influenced by various factors, including genetics and hormones, particularly dihydrotestosterone, which induces hair follicle miniaturization and disrupts the hair growth cycle.^{9,10} Consequently, the presentation of AGA may vary across different ethnic groups and study populations.^{11,12} Early intervention in AGA is crucial to preserving hair follicles and minimizing irreversible fibrotic damage.¹⁰ However, its treatment remains challenging due to the chronic nature of the condition and the interplay of multiple contributing factors.¹³ Various therapeutic approaches have been

explored, with emerging regenerative therapies demonstrating superior potential compared to traditional pharmacological treatments, offering long-lasting efficacy with fewer side effects.^{10,13,14} Among these emerging treatments, Platelet-Rich Plasma (PRP) has gained widespread application across various medical fields due to its ability to promote cell proliferation and differentiation through cytokines and growth factors, thereby stimulating hair follicle growth.^{15–17} Although numerous studies have highlighted the efficacy of PRP in AGA treatment, others have reported inconsistent results, failing to demonstrate significant improvements in hair count and density.^{17–21} Furthermore, data on the effectiveness of PRP therapy, as well as the characteristics of AGA, in the Vietnamese population remain limited. Therefore, this study aims to evaluate the treatment outcomes of PRP therapy in affected patients, providing robust evidence for its clinical application.

Materials and Methods

Study Settings and Participants

This prospective, non-controlled clinical study was conducted at Can Tho University of Medicine and Pharmacy Hospital and Can Tho Dermatology Hospital, Vietnam. These hospitals are major provincial-level medical centers in the Mekong Delta region of Vietnam. The study period extended from December 2022 to March 2024. All patients were treated and followed for a complete duration of three months (from T0 to T3) as per the study protocol, ensuring that the final patient completed full follow-up before June 2024, which marked the end of the study.

Eligible participants included both male and female, aged 18 years or older, clinically diagnosed with androgenetic alopecia and who had not received any topical or systemic treatments for hair loss within the previous 6 months, and who adhered wholly to the prescribed treatment regimen, were enrolled in the study. Individuals with a history of or currently diagnosed with immunosuppressive conditions (eg, cancer, chemotherapy, corticosteroid therapy), dermatological disorders affecting the scalp, autoimmune diseases, hematological disorders, platelet dysfunction syndromes, or those taking anticoagulant medications were excluded. Patients currently using aspirin or non-steroidal anti-inflammatory drugs were required to discontinue their medications at least 7 days before treatment initiation. Additionally, pregnant or breastfeeding women were also excluded from the study. AGA is diagnosed based on the patient's history, the pattern of alopecia, the family incidence of AGA or trichoscopic findings.²²

The required sample size was calculated using the formula $n = Z_{1-\frac{\alpha}{2}}^2 \frac{p(1-p)}{d^2}$ where p represents the estimated proportion of patients achieving a negative hair pull test (defined as fewer than 5 hairs) after three treatment sessions. This value was derived from a prior study by Özer et al,²³ which reported a response rate of 93.3%. Assuming a 8% margin of error and a Z-value of 1.96 corresponding to a 95% confidence level ($\alpha = 0.05$), the minimum sample size was determined to be 38 participants. Ultimately, a total of 41 eligible patients were enrolled in the study.

The study's procedure and protocol were approved by the Research Ethics Review Committee of Can Tho University of Medicine and Pharmacy, Vietnam (approval number: 22.358.HV.PCT-HĐĐĐ, dated August 12, 2022), and were conducted by the ethical principles outlined in the Declaration of Helsinki. All participants provided written informed consent.

Patient Evaluation

The severity of androgenetic alopecia was classified using the Hamilton-Norwood scale from type I to V for men and the Ludwig scale from type I to III for women.²² In our study, the severity grading of AGA patients was determined according to Sathyanarayanan (2024), based on Hamilton and Ludwig classifications, and categorized into three levels.²⁴ The mild level includes Hamilton type I for men and Ludwig type I for women. The moderate level comprises Hamilton type II for men and Ludwig type II for women. The severe level includes Hamilton types III, IV, and V for men and Ludwig type III for women.

Hair pull test: Firmly grasp 20 to 60 hair strands using the thumb, index, and middle fingers close to the scalp (at the proximal end), and gently pull with consistent traction along the hair shaft. The test was performed at the transition zone between thinning hair and normal hair, typically located in the frontal or vertex region depending on the pattern and

extent of hair loss. The test is considered positive if more than 10% of the hair strands (≥ 5 –6 hairs) are shed, indicating active hair loss. Patients do not shampoo their hair within 48 hours before performing this test.²⁵

Evaluation of treatment outcomes: The evaluated parameters included hair loss, hair density (number of hairs/cm²), patient satisfaction, and adverse effects. Evaluations were conducted independently by two specialists who were not involved in the PRP injection procedure. Assessment methods included the hair pull test, dermoscopic photomicrographs (DermLite DL4, USA), macroscopic photographs (captured with an iPhone 13 Pro Max, 12MP camera), and patient satisfaction questionnaires. All patients were assessed at four time points: baseline (T0), after 4 weeks (T1), after 8 weeks (T2), and after 12 weeks (T3).

Patient Evaluation

Efficacy

This study utilized the KIT-NEW PRPPRO KIT Ver.5 (Geneworld) for PRP preparation. Initially, three blood tubes, each containing 8.5 mL, were collected. Subsequently, all three tubes were centrifuged at 2100 rpm for 10 minutes to separate the plasma component. After centrifugation, approximately 15 mL of the upper yellow plasma layer was carefully aspirated and transferred into a tube labeled “PLASMA”.

Next, the PLASMA tube was centrifuged again at 1,100 rpm for 10 minutes. After centrifugation, the yellow fluid was gently transferred into another PLASMA tube, leaving precisely 0.5 mL behind. This remaining volume was mixed thoroughly, transferred entirely into the FACESKIN tube, remixed, and stored at 4°C.

The remaining PLASMA tube underwent further centrifugation at 3,700 rpm for 5 minutes. Following centrifugation, the upper yellow fluid was transferred into a blue-capped PPP tube labeled “PPP” and thoroughly mixed, leaving approximately 3 mL at the bottom. Clot formation was observed in the PPP tube. The remaining 3 mL fluid was thoroughly mixed and transferred into the PRP tube, continuing to mix until clot formation occurred.

After the fluid within the PRP and PPP tubes had coagulated, a pipette was gently rotated to detach the clot from the tube wall. The clots were allowed to retract completely, after which the solidified clots were discarded. Finally, all remaining yellow fluid from the PPP tube was aspirated into another tube labeled “PPP2”, thoroughly mixed, and subsequently divided into 12–14 sterile plastic tubes containing approximately 1 mL, completing the sample preparation process.

Platelet-Rich Plasma Injection

Before treatment, all patients received detailed explanations of the procedure and potential adverse effects and provided written informed consent to participate. Patients were instructed to avoid washing their hair for two days before treatment. Local anesthesia was achieved using topical Emla 5% cream applied approximately 40–45 minutes before injection. The anesthetic cream was then wiped off with physiological saline, followed by antiseptic preparation of the treatment area using povidone-iodine 10%. No patient used any other hair loss treatment methods throughout the study.

The hair-loss area was divided into multiple 1 cm² squares. PRP was injected subcutaneously into the center of each square using a 27G needle at a depth of 3–5 mm, with a dose of 0.2–0.3 mL per injection site, totaling 3–5 mL of PRP per session. After injection, the treated area was cleaned with sterile 0.9% NaCl solution, followed by applying sterile gauze and gentle pressure until bleeding ceased. The treatment protocol consisted of three injection sessions at four-week intervals study.

Data and Statistical Analyses

The collected data were organized, tabulated, and statistically analyzed using SPSS version 27. For categorical data, frequency and percentage distributions were calculated. Range, mean, and standard deviation (SD) were determined for numerical variables. The Kolmogorov–Smirnov test was used to assess the normal distribution of quantitative variables. Hair density was expressed as mean $\pm$ SD. A paired sample *t*-test was performed to compare the mean hair density values across different time points. Spearman’s rank correlation coefficient (ρ) was calculated to assess the relationship between platelet concentration and hair density improvement. Changes in the hair pull test results across different time points were evaluated using the McNemar test. Where appropriate, the association between categorical variables (eg, AGA severity

and clinical characteristics) was tested using the Chi-square test (χ^2) or Fisher's Exact Test. A p-value < 0.05 was considered statistically significant.

Results

A total of 41 participants (17 men and 24 women) were recruited and followed up after three treatment sessions until the end of the study. More than half of the participants resided in urban areas (53.7%), with a mean age of 34.73 ± 13.05 years. There was no statistically significant difference in age between men and women (31.12 ± 11.24 vs 37.29 ± 13.84 , $p > 0.05$). Table 1 shows that Hamilton type III and Ludwig type II were men's and women's most common hair loss patterns, respectively. On trichoscopy, most patients exhibited hair shaft diameter diversity (90.2%) and an increased proportion of vellus hairs (53.7%). The mean duration of disease among patients was 4.44 ± 2.66 years.

Among the 41 patients, the proportions of mild and severe cases were 56.1% and 43.9%, respectively, with no significant difference between groups. Analysis showed that male sex, prolonged disease duration (≥ 5 years), family history of AGA, and positive hair pull test were significantly associated with severe androgenetic alopecia ($p < 0.05$) (Table 2).

During treatment, mean hair density significantly increased across the evaluation time points, starting from 40.76 ± 14.26 at baseline (T0) to 49.80 ± 15.42 at week 4 (T1), 59.80 ± 15.71 at week 8 (T2), and reaching 66.00 ± 18.00 at week 12 (T3). The differences in mean hair density between these time points were statistically significant ($p < 0.001$) (Figure 1). Figures 2 and 3 provides a representative example of the improvement in hair density following treatment.

Regarding hair pull test results, the proportion of patients with positive hair pull tests decreased progressively throughout the treatment course. Specifically, the percentage declined markedly from baseline (T0: 75.6%) to 46.3% at week 4 (T1), 29.3% at week 8 (T2), and ultimately to 12.2% at week 12 (T3). These differences were statistically significant across evaluation time points ($p < 0.001$ for comparisons of T1, T2, T3 vs T0, and T2, T3 vs T1; $p = 0.016$ for the comparison between T3 and T2).

Table 1 Categories, Dermoscopy Characteristics, and Duration of Disease of Androgenetic Alopecia Titles

Characteristics		Frequency	Percentage (%)
Hamilton Classification (n = 17)	Type II	4	23.5
	Type III	8	47.1
	Type IV	4	23.5
	Type V	1	5.9
Ludwig Classification (n = 24)	Type I	8	33.3
	Type II	11	45.8
	Type III	5	20.8
Trichoscopy (n = 41)	Yellow dots	20	48.8
	Variability in hair shaft diameter	37	90.2
	Increased proportion of vellus hairs	22	53.7
	Peripilar sign/erifollicular pigmentation	13	31.7
	Empty hair follicles	13	31.7
AGA duration, Mean $\pm$ SD		4.44 $\pm$ 2.66 (years)	

Abbreviations: AGA, androgenetic alopecia; SD, standard deviation.

Table 2 Severity of Androgenetic Alopecia

Characteristics		Mild	Severe	p-value
Age	< 30 years	10 (23.5)	7 (41.2)	0.767**
	≥ 30 years	13 (54.2)	11 (45.8)	
Sex	Male	4 (23.5)	13 (76.5)	0.001*
	Female	19 (79.2)	5 (20.8)	
Disease duration	< 5 years	18 (75.0)	6 (25.0)	0.004**
	≥ 5 years	5 (29.4)	12 (70.6)	
Family history of AGA	Yes	10 (35.7)	18 (64.3)	< 0.001*
	No	13 (100)	0 (0.0)	
Pull test	Positive	14 (45.2)	17 (54.8)	0.025*
	Negative	9 (90.0)	1 (10.0)	
Total		23 (56.1)	18 (43.9)	-

Notes: *Fisher's Exact test, **Chi-squared test.

Figure 4 illustrates the correlation between increased hair density and patient platelet concentration. The results indicate that higher platelet concentrations were associated with more significant increases in hair density, with a moderate positive correlation between increased hair density and platelet concentration ($r = 0.455$, $p < 0.001$).

Following treatment, the proportion of patients satisfied or very satisfied with treatment outcomes was notably high (97.6%). Common minor adverse effects included itching at the injection site (22.0%) and scalp discomfort or pain (7.3%) (Table 3).

Discussion

Androgenetic alopecia is a progressive disorder that significantly impacts patients' psychological well-being and quality of life. In this study, 41 patients with AGA, mostly at moderate to severe stages, underwent treatment with autologous PRP. Upon completion of the treatment sessions, efficacy was demonstrated through hair pull tests and increased hair density compared to baseline. Most patients expressed satisfaction with the outcomes and experienced minimal adverse effects.

The study findings indicate that male patients with AGA are predominantly classified as Hamilton Type III or IV. In contrast, female patients are more commonly categorized as Ludwig Type I or II. Hamilton Type III and IV represent hair loss patterns that tend to approach or surpass the midcoronal line, while Ludwig Type I and II are characterized by significant hair thinning in women before the onset of complete baldness.²⁶ Thus, regardless of gender, patients seek medical consultation when hair loss occurs, as this condition directly affects their appearance, self-confidence, and social

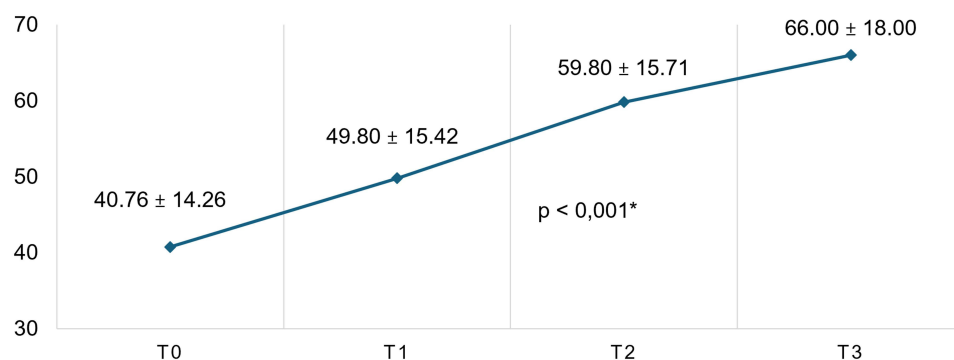


Figure 1 Hair density at different time points. *When comparing different time points (T1,2,3 vs T0, T2,3 vs T1, T3 vs T2), Paired Samples T-Test.

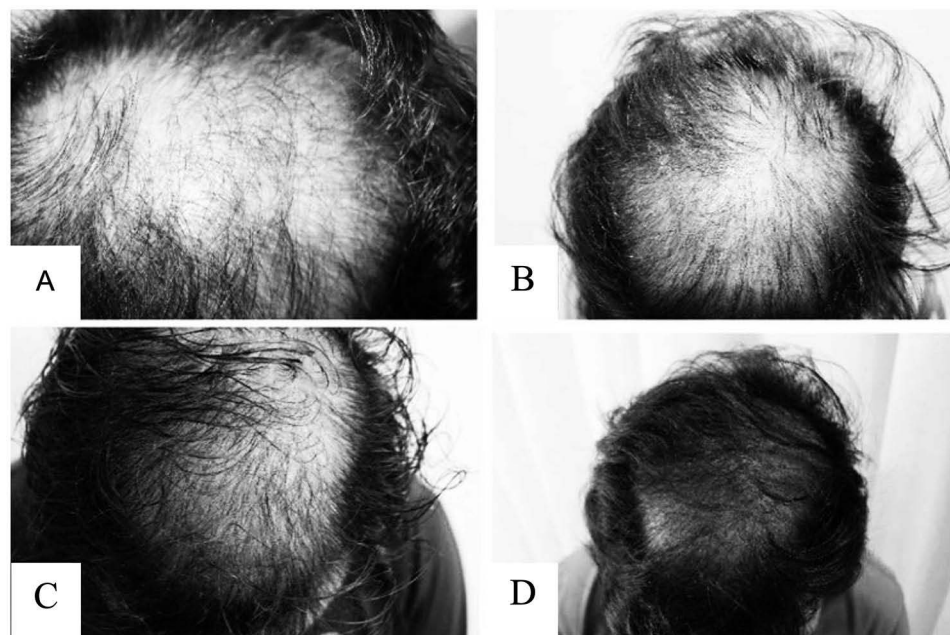


Figure 2 A 26-year-old male patient pre- and post-treatment. (A (T0)), (B (T1)), (C (T2)), (D (T3)).



Figure 3 A 29-year-old female patient pre- and post-treatment. (A (T0)), (B (T1)), (C (T2)), (D (T3)).

interactions.²⁷ However, women are more likely to seek treatment at earlier stages of alopecia than men, as they generally have a heightened awareness of their appearance.²⁸ These findings are also consistent with a study conducted in a Korean population.²⁹ On trichoscopy, most patients exhibited variability in hair shaft diameter, an increased proportion of vellus hairs, yellow dots, and peripilar signs, while empty hair follicles were observed at lower rates. These findings are consistent with the pathogenesis of AGA, where the conversion of free testosterone to dihydrotestosterone leads to heterogeneous follicular miniaturization, an increased number of vellus hairs, and androgen-mediated suppression of the

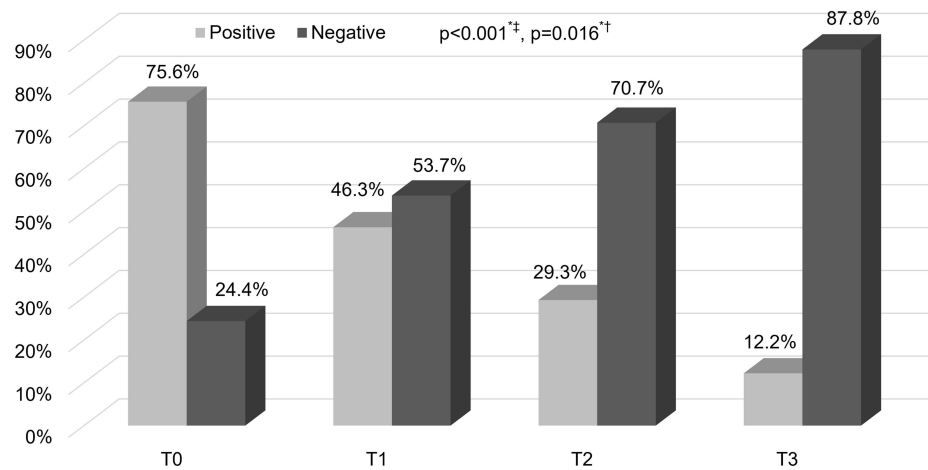


Figure 4 Changes in hair pull test results at different time points. *McNemar Test, †Comparison of T1, T2, T3 vs T0; T2, T3 vs T1, ‡Comparison of T3 vs T2.

anagen phase, reflected by a more significant number of follicular units and yellow dots.³⁰ Several studies have reported higher prevalence rates of these trichoscopic markers compared to our findings,^{31,32} and some have demonstrated that these features can aid in diagnosing AGA with relatively high specificity on trichoscopy.^{33,34} When assessing the severity of AGA, we identified statistically significant differences in the distribution of severity levels based on gender, duration of AGA, family history of AGA, and the pull test ($p < 0.05$). However, no significant association was found with age. In contrast to our findings, studies by Yi Y et al and Salman et al reported that the prevalence of AGA and its severity increases with age.^{35,36} Meanwhile, other studies have observed similar associations between gender and disease severity.³⁷ We hypothesize that these differences may be attributed to greater exposure to risk factors in men, such as smoking, unhealthy dietary habits, poor sleep hygiene, obesity, and alcohol consumption.^{36,38–40} Additionally, prolonged disease duration exacerbates the impact of dihydrotestosterone on hair follicles, leading to anagen phase shortening, telogen phase prolongation, and increased follicular miniaturization. As a result, hair shedding intensifies, and follicular degeneration becomes more severe, contributing to progressive baldness.^{9,41} Furthermore, the pull test reflects the degree of hair loss and is an assessment tool for AGA severity in this study. Although the pull test primarily indicates telogen hair shedding, a part of the AGA pathophysiology involving an increased proportion of telogen hairs, it should not be used as a decisive diagnostic tool in patients with chronic telogen effluvium, such as AGA without considering additional diagnostic factors.²⁵

Over the past decade, autologous PRP has emerged as a promising regenerative treatment option for AGA in both men and women. Randomized controlled trials (RCTs) and meta-analyses have demonstrated that PRP significantly improves hair density and count.^{42,43} Results from our study align with this general trend, demonstrating marked improvement in hair density following PRP treatment, consistent with international reports on the efficacy of PRP. For

Table 3 Levels of Patient Satisfaction and Adverse Effects Following Treatment

Variables		Frequency	Percentage (%)
Levels of satisfaction	Very unsatisfied	0	0.0
	Unsatisfied	1	2.4
	Satisfied	33	80.5
	Very satisfied	7	17.1
Adverse effects	Scalp discomfort/pain	3	7.3
	Itching at the injection site	9	22.0

instance, a meta-analysis of nine RCTs reported a statistically significant increase in hair density after 3–6 months of PRP treatment compared with placebo injections.⁴⁴ A meta-analysis pooling 17 treatment groups revealed that the mean hair density increased from approximately 142 to 177 hairs/cm² following PRP therapy (an increase of approximately 35 hairs/cm², $p = 0.0004$).⁴⁵ Several other RCTs have reported similar trends. Gentile et al (2015) observed an average increase of approximately 33 hairs in the target area and an increase of 45.9 hairs/cm² in hair density after three PRP injections, accompanied by notable histological improvements.⁴⁶ Gkini et al (2014) reported hair density peaking at approximately 170 hairs/cm² after 3 months, remaining significantly higher than baseline at 6 months and 1 year following an additional PRP booster injection ($p < 0.001$).²¹ Similarly, Alves and Grimalt (2016), in a split-scalp design study, found significantly increased hair density and anagen hair percentage on the PRP-treated side compared to placebo after 6 months.⁴² Notably, the observed increases in hair density generally fall within the typical range reported in other studies (approximately 12–46 hairs/cm², equivalent to a 20–30% improvement from baseline).^{45–48} Additionally, most authors have noted high levels of patient satisfaction and few adverse effects. Local reactions such as mild pain, swelling, or redness were usually transient; no serious PRP-related adverse events were reported.^{21,42,44,49} This emphasizes the safety and tolerability of PRP therapy, representing a significant advantage over standard treatments such as topical minoxidil and oral finasteride. The hair-growth-promoting effects of PRP have a robust scientific basis rooted in a clear understanding of its underlying mechanisms. PRP, or platelet-rich plasma, is derived from the patient's blood through centrifugation and contains high concentrations of growth factors released from platelets, such as PDGF, VEGF, TGF- β 1, EGF, IGF-1, and FGF. These growth factors collectively stimulate the proliferation of hair follicle stem cells, promote angiogenesis, supply nutrients to follicles, modulate inflammation, and prolong the anagen phase.^{50–53} These multifaceted biological effects partially reverse the inflammatory and degenerative processes affecting hair follicles in AGA. Indeed, AGA is characterized by follicular miniaturization resulting from shortened anagen phases, prolonged telogen phases, and chronic inflammatory infiltration around the follicles.⁴³ With its anti-inflammatory and regenerative properties, PRP reduces perifollicular inflammation and local oxidative stress, thus creating a favorable microenvironment for weakened follicles to recover.⁴⁵ Concurrently, PRP significantly increases the number of follicles in the growth phase and enhances hair shaft diameter compared to control areas.⁵⁴ Gentile et al further observed beneficial microscopic changes following PRP treatment, including increased stem cell proliferation (Ki-67 marker) within the hair bulge region, higher density of small blood vessels around hair follicles, and increased epidermal thickness.⁴⁶ These findings strongly support the hypothesis that PRP creates an optimal microenvironment facilitating hair follicle recovery and growth.

Although most studies report positive outcomes, there remain differences among studies regarding the extent of effectiveness. A notable commonality is that PRP generally enhances hair density to varying degrees; however, absolute improvements may fluctuate depending on study design, PRP preparation techniques, and participant characteristics. For example, a 2023 meta-analysis demonstrated that PRP significantly increased hair density compared to placebo, yet differences in hair count and diameter were not statistically significant in specific individual trials.⁴⁴ This discrepancy might stem from small sample sizes or short follow-up periods in some RCTs, limiting the clear demonstration of PRP's effectiveness compared to placebo. Additionally, patient-specific factors and the severity of hair loss conditions significantly influence treatment outcomes. Alves (2016) noted younger patients (≤ 40 years) tended to respond better with increased hair density,⁴² consistent with recent meta-analytical findings indicating an inverse correlation between age and improvement in hair density (younger groups showing significantly higher improvement rates; $r = -0.56$, $p = 0.016$).⁴⁵ Conversely, long-standing or advanced-stage hair loss may limit PRP responsiveness. Indeed, a 2020 randomized placebo-controlled pilot study involving 30 men with androgenetic alopecia found no significant improvement in hair count or diameter compared to placebo.⁵⁵ This outlier result was attributed to patient selection criteria—specifically, severe-stage hair loss and exclusively male participants—which potentially masked PRP efficacy within the limited observation period. Thus, variability across studies predominantly arises from differences in patient population characteristics and PRP technical protocols. Studies employing rigorous designs, selecting appropriate patients (moderate hair loss with viable follicles), and implementing optimal treatment regimens report positive PRP outcomes.^{45,56} However, suboptimal results may occur if patients have advanced-stage hair loss (significant follicular degeneration) or if treatment protocols are not optimized.

An important point is the necessity of standardizing PRP treatment protocols to optimize therapeutic outcomes. Although studies have employed different commercial kits and centrifugation parameters, most recommend multiple injections of PRP at sufficiently high platelet concentrations.^{45,57–60} A systematic review by Li et al (2023) suggests an optimal protocol comprising at least three PRP injections administered approximately one month apart, with volumes ranging from 0.05 to 0.1 mL PRP per cm² of scalp per session. The authors even propose a booster session about 3–6 months following the initial course to sustain hair growth effectiveness.⁵⁷ The analysis by Andriolo et al (2022) was the first to demonstrate a positive correlation between monthly PRP injection frequency and hair growth rate, revealing that the group with higher injection frequency achieved significantly greater increases in hair density ($r = 0.5$, $p = 0.03$).⁴⁵ This finding explains why protocols involving multiple injections (4–6 sessions) exhibit superior outcomes. Indeed, a study combining PRP with microneedling in 60 resistant cases reported that 66% of patients experienced significant improvement after only four PRP sessions; most did not require more than 4–6 sessions to achieve desired results.⁵⁸ Based on this experience, the authors concluded that a minimum of four PRP sessions is recommended for optimal efficacy. In addition to optimizing the number of injections, platelet concentration in PRP significantly impacts treatment outcomes. Evidence indicates that the efficacy of hair regrowth stimulation is directly proportional to platelet concentration, but only up to a certain threshold. Platelet concentrations around ≥ 1 million/ μ L (approximately 4–7 times the average baseline) are considered therapeutically effective. Concentrations that are too low might fail to deliver sufficient growth factors. In contrast, excessively high levels (exceeding ~ 1.5 million/ μ L) could exert inhibitory effects due to imbalanced proliferative signaling.^{59,60} Garg et al (2017) described a “bell-shaped curve” phenomenon for PRP, in which the optimal dose provides maximal angiogenesis, while doses that are either too high or too low reduce the angiogenic response necessary for hair growth.⁶⁰ Consequently, commercial PRP systems typically aim for platelet concentrations approximately 5–10 times above normal levels to ensure adequate platelet density for effective and consistent hair follicle stimulation.

In summary, the aggregation of current evidence suggests that autologous PRP, with properly standardized centrifugation protocols, is a safe and effective method for treating androgenetic alopecia in both genders. Our findings align broadly with published literature, further reinforcing confidence in PRP’s effectiveness in improving hair density and quality. Despite minor differences across studies regarding sample sizes, methodologies, and patient populations, a prominent commonality is that most patients receiving correctly administered PRP experience enhanced hair thickness, increased hair shaft diameter, and notable improvement in thinning areas. However, alongside these significant findings, our study does have some limitations. The relatively small sample size may affect the generalizability of results. Additionally, the absence of a control group reduces the precision of evaluating PRP’s specific contribution to observed improvements. Furthermore, the short follow-up duration is insufficient to thoroughly assess PRP’s long-term effectiveness in treating AGA. Nevertheless, a notable strength of this study is its multicenter design, which enhances the objectivity and practical applicability of the findings in clinical practice.

Conclusion

Overall, the study provides valuable additional data regarding the efficacy and safety of platelet-rich plasma for androgenetic alopecia treatment. Platelet-rich plasma therapy demonstrates significant efficacy in treating androgenetic alopecia, resulting in notable improvements in hair density, reduced hair loss, and high patient satisfaction rates. Platelet-rich plasma is well-tolerated, with mild side effects and no serious adverse events reported.

Abbreviations

AGA, androgenetic alopecia; PRP, platelet-rich plasma; SD, standard deviation; RCTs, randomized controlled trials.

Data Sharing Statement

The data supporting this study are available from the corresponding author upon reasonable request.

Ethics Approval and Informed Consent

The study's methodology and protocol were approved by the Research Ethics Review Committee of Can Tho University of Medicine and Pharmacy, Vietnam (approval number: 22.358.HV.PCT-HDDD, dated August 12, 2022). This research was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants involved in the study.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Consent for Publication

All authors confirm that consent for publication has been obtained where applicable.

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Disclosure

The authors have declared that no competing interests exist regarding the publication of this study.

References

1. Almodimeegh A, Alajlan AH, Alrasheed AI, et al. The impact, prevalence, and association of different forms of hair loss among individuals with anxiety disorder: systematic review and meta-analysis. *Medicine*. 2025;104(6):e41457. doi:10.1097/MD.00000000000041457
2. Valdez-Zertuche JA, Ramirez-Marín HA, Tosti A. Efficacy, safety and tolerability of drugs for alopecia: a comprehensive review. *Expert Opin Drug Metab Toxicol*. 2025;1–25.
3. Abdelkader A, Abdallah IY, Abdeen A, Ibrahim SE. Androgenetic alopecia: an overview. *Benha J Appl Sci*. 2024;9(2):37–50. doi:10.21608/bjas.2024.259966.1306
4. Desai S, Sanfilippo E, Friedman A. Oral minoxidil media coverage: the impact on patient perceptions and practitioner approaches to androgenetic alopecia. *J Drugs Dermatol*. 2024;23(1):1364–1366. doi:10.36849/JDD.7730
5. Sakhiya J, Sakhiya D, Modi M, Gandhi S, Daruwala F. Prevalence, severity and associated factor of androgenetic alopecia in the dermatology outpatient clinic: a retrospective study. *IP Indian J Clin Exp Dermatol*. 2019;5(4):280–287. doi:10.18231/j.ijced.2019.060
6. Frith H, Jankowski GS. Psychosocial impact of androgenetic alopecia on men: a systematic review and meta-analysis. *Psychol Health Med*. 2024;29(4):822–842. doi:10.1080/13548506.2023.2242049
7. Aukerman EL, Jafferany M. The psychological consequences of androgenetic alopecia: a systematic review. *J Cosmet Dermatol*. 2023;22(1):89–95. doi:10.1111/jocd.14983
8. Li H, Cai H, Li P, Zeng Y, Zhang Y. Assessing causality between androgenetic alopecia with depression: a bidirectional Mendelian randomization study. *Clin Cosmet Invest Dermatol*. 2025;18:445–451. doi:10.2147/CCID.S501182
9. Kidangazhiathmana A, Santhosh P. Pathogenesis of androgenetic alopecia. *Clin Dermatol Rev*. 2022;6(2):69–74. doi:10.4103/cdr.cdr_29_21
10. Pozo-Pérez L, Tornero-Esteban P, López-Bran E. Clinical and preclinical approach in AGA treatment: a review of current and new therapies in the regenerative field. *Stem Cell Res Ther*. 2024;15(1):260. doi:10.1186/s13287-024-03801-5
11. Aggarwal I, Puyana C, Chandan N, Haber R. 42173 racial and ethnic disparities in androgenetic alopecia clinical trials in the USA. *J Am Acad Dermatol*. 2023;89(3):AB214. doi:10.1016/j.jaad.2023.07.859
12. Flament F, Maudet A, Barbarat P, et al. Types and characteristics of hair across the globe: results of a multinational study on 19,461 individuals. *Clin Cosmet Invest Dermatol*. 2025;18:393–404. doi:10.2147/CCID.S377009
13. Devjani S, Ezemma O, Kelley KJ, Stratton E, Senna M. Androgenetic alopecia: therapy update. *Drugs*. 2023;83(8):701–715. doi:10.1007/s40265-023-01880-x
14. Kaiser M, Abidin R, Gaumond SI, Issa NT, Jimenez JJ. Treatment of androgenetic alopecia: current guidance and unmet needs. *Clin Cosmet Invest Dermatol*. 2023;16:1387–1406. doi:10.2147/CCID.S385861

15. Pretorius J, Habash M, Ghobrial B, Alnajjar R, Ellanti P. Current status and advancements in platelet-rich plasma therapy. *Cureus*. 2023;15(10):e47176. doi:10.7759/cureus.47176
16. Zhang Z, Liu P, Xue X, et al. The role of platelet-rich plasma in biomedicine: a comprehensive overview. *iScience*. 2025;28(2):111705. doi:10.1016/j.isci.2024.111705
17. Stevens J, Khetarpal S. Platelet-rich plasma for androgenetic alopecia: a review of the literature and proposed treatment protocol. *Int J Womens Dermatol*. 2019;5(1):46–51. doi:10.1016/j.ijwd.2018.08.004
18. Khatu SS, More YE, Gokhale NR, Chavhan DC, Bendsure N. Platelet-rich plasma in androgenic alopecia: myth or an effective tool. *J Cutan Aesthet Surg*. 2014;7(2):107–110. doi:10.4103/0974-2077.138352
19. Puig CJ, Reese R, Peters M. Double-blind, placebo-controlled pilot study on the use of platelet-rich plasma in women with female androgenetic alopecia. *Dermatol Surg*. 2016;42(11):1243–1247. doi:10.1097/DSS.0000000000000883
20. Ayatollahi A, Hosseini H, Shahdi M, et al. Platelet-rich plasma by single spin process in male pattern androgenetic alopecia: is it an effective treatment? *Indian Dermatol Online J*. 2017;8(6):460–464. doi:10.4103/idoj.IDOJ_11_17
21. Gkini MA, Kouskousis AE, Tripsianis G, Rigopoulos D, Kouskousis K. Study of platelet-rich plasma injections in the treatment of androgenetic alopecia through an one-year period. *J Cutan Aesthet Surg*. 2014;7(4):213–219. doi:10.4103/0974-2077.150743
22. Wolff K, Johnson R, Saavedra A. *Fitzpatrick's Color Atlas and Synopsis of Clinical Dermatology*. Seventh edition ed. McGraw Hill Professional; 2017.
23. Özer K, Çolak Ö. Clinical results of platelet-rich plasma injection in the treatment of androgenetic alopecia. *Europ Arch Med Res*. 2019;35(1):33. doi:10.4274/eamr.galenos.2018.43531
24. Sathyanarayanan H, Sundaram M. Study of association of dyslipidemia in male androgenetic alopecia patients in a tertiary care hospital. *Cureus*. 2024;16(1):e51741. doi:10.7759/cureus.51741
25. McDonald KA, Shelley AJ, Colantonio S, Beecker J. Hair pull test: evidence-based update and revision of guidelines. *J Am Acad Dermatol*. 2017;76(3):472–477. doi:10.1016/j.jaad.2016.10.002
26. Gupta M, Mysore V. Classifications of patterned hair loss: a review. *J Cutan Aesthet Surg*. 2016;9(1):3–12. doi:10.4103/0974-2077.178536
27. Dhami L. Psychology of hair loss patients and importance of counseling. *Indian J Plast Surg*. 2021;54(4):411–415. doi:10.1055/s-0041-1741037
28. He J, Sun S, Zickgraf HF, Lin Z, Fan X. Meta-analysis of gender differences in body appreciation. *Body Image*. 2020;33:90–100. doi:10.1016/j.bodyim.2020.02.011
29. Paik JH, Yoon JB, Sim WY, Kim BS, Kim NI. The prevalence and types of androgenetic alopecia in Korean men and women. *Br J Dermatol*. 2001;145(1):95–99. doi:10.1046/j.1365-2133.2001.04289.x
30. Kuczara A, Waśkiel-Burnat A, Rakowska A, Olszewska M, Rudnicka L. Trichoscopy of androgenetic alopecia: a systematic review. *J Clin Med*. 2024;13(7):1962. doi:10.3390/jcm13071962
31. Kibar M, Aktan S, Bilgin M. Scalp dermatoscopic findings in androgenetic alopecia and their relations with disease severity. *Ann Dermatol*. 2014;26(4):478–484. doi:10.5021/ad.2014.26.4.478
32. Kasumagic-Halilovic E. Trichoscopic findings in androgenetic alopecia. *Med Arch*. 2021;75(2):109–111. doi:10.5455/medarh.2021.75.109-111
33. Rakowska A, Slowinska M, Kowalska-Oledzka E, Olszewska M, Rudnicka L. Dermoscopy in female androgenic alopecia: method standardization and diagnostic criteria. *Int J Trichol*. 2009;1(2):123–130. doi:10.4103/0974-7753.58555
34. Ummiti A, Priya PS, Chandravathi PL, Kumar CS. Correlation of trichoscopic findings in androgenetic alopecia and the disease severity. *Int J Trichol*. 2019;11(3):118–122. doi:10.4103/ijt.ijt_103_17
35. Salman KE, Altunay IK, Kucukunal NA, Cerman AA. Frequency, severity and related factors of androgenetic alopecia in dermatology outpatient clinic: hospital-based cross-sectional study in Turkey. *An Bras Dermatol*. 2017;92(1):35–40. doi:10.1590/abd1806-4841.20175241
36. Yi Y, Qiu J, Jia J, et al. Severity of androgenetic alopecia associated with poor sleeping habits and carnivorous eating and junk food consumption-A web-based investigation of male pattern hair loss in China. *Dermatol Ther*. 2020;33(2):e13273. doi:10.1111/dth.13273
37. Baghani M, Pourani MR, Nekooghadam SM, et al. Androgenetic alopecia and COVID-19: is there a clinical connection? *J Cosmet Dermatol*. 2022;21(2):420–425. doi:10.1111/jocd.14670
38. Liu LP, Wariboko MA, Hu X, Wang ZH, Wu Q, Li YM. Factors associated with early-onset androgenetic alopecia: a scoping review. *PLoS One*. 2024;19(3):e0299212. doi:10.1371/journal.pone.0299212
39. Zhang J, Wu Y, Wang F. The association between alcohol consumption and the severity of male androgenic alopecia in Chinese participants: a single-center cross-sectional study. *J Am Acad Dermatol*. 2025;92(1):175–177. doi:10.1016/j.jaad.2024.08.079
40. Yang CC, Hsieh FN, Lin LY, Hsu CK, Sheu HM, Chen W. Higher body mass index is associated with greater severity of alopecia in men with male-pattern androgenetic alopecia in Taiwan: a cross-sectional study. *J Am Acad Dermatol*. 2014;70(2):297–302.e1. doi:10.1016/j.jaad.2013.09.036
41. Sinclair R, Torkamani N, Jones L. Androgenetic alopecia: new insights into the pathogenesis and mechanism of hair loss. *F1000Res*. 2015;4:585. doi:10.12688/f1000research.6401.1
42. Alves R, Grimalt R. Randomized placebo-controlled, double-blind, half-head study to assess the efficacy of platelet-rich plasma on the treatment of androgenetic alopecia. *Dermatol Surg*. 2016;42(4):491–497. doi:10.1097/DSS.0000000000000665
43. Gentile P, Garcovich S. Systematic review of platelet-rich plasma use in androgenetic alopecia compared with minoxidil[®], finasteride[®], and adult stem cell-based therapy. *Int J Mol Sci*. 2020;21(8). doi:10.3390/ijms21082702
44. Zhang X, Ji Y, Zhou M, et al. Platelet-rich plasma for androgenetic alopecia: a systematic review and meta-analysis of randomized controlled trials. *J Cutan Med Surg*. 2023;27(5):504–508. doi:10.1177/12034754231191461
45. Georgescu SR, Amuzescu A, Mitran CI, et al. Effectiveness of platelet-rich plasma therapy in androgenic alopecia-a meta-analysis. *J Pers Med*. 2022;12(3):342. doi:10.3390/jpm12030342
46. Gentile P, Garcovich S, Bielli A, Scioli MG, Orlandi A, Cervelli V. The effect of platelet-rich plasma in hair regrowth: a randomized placebo-controlled trial. *Stem Cells Transl Med*. 2015;4(11):1317–1323. doi:10.5966/sctm.2015-0107
47. Cruciani M, Masiello F, Pati I, Marano G, Pupella S, De Angelis V. Platelet-rich plasma for the treatment of alopecia: a systematic review and meta-analysis. *Blood Transfus*. 2023;21(1):24–36. doi:10.2450/2021.0216-21
48. Giordano S, Romeo M, Di Summa P, Salval A, Lankinen P. A meta-analysis on evidence of platelet-rich plasma for androgenetic alopecia. *Int J Trichol*. 2018;10(1):1–10. doi:10.4103/ijt.ijt_74_16

49. Cervelli V, Garcovich S, Bielli A, et al. The effect of autologous activated platelet rich plasma (AA-PRP) injection on pattern hair loss: clinical and histomorphometric evaluation. *Biomed Res Int.* 2014;2014:760709. doi:10.1155/2014/760709
50. Abdin R, Zhang Y, Jimenez JJ. Treatment of androgenetic alopecia using PRP to target dysregulated mechanisms and pathways. *Front Med Lausanne.* 2022;9:843127. doi:10.3389/fmed.2022.843127
51. Gentile P, Garcovich S. Advances in regenerative stem cell therapy in androgenic alopecia and hair loss: wnt pathway, growth-factor, and mesenchymal stem cell signaling impact analysis on cell growth and hair follicle development. *Cells.* 2019;8(5):466. doi:10.3390/cells8050466
52. Gentile P, Scioli MG, Bielli A, et al. Platelet-rich plasma and micrografts enriched with autologous human follicle mesenchymal stem cells improve hair re-growth in androgenetic alopecia. biomolecular pathway analysis and clinical evaluation. *Biomedicines.* 2019;7(2):27. doi:10.3390/biomedicines7020027
53. Gentile P, Cole JP, Cole MA, et al. Evaluation of not-activated and activated PRP in hair loss treatment: role of growth factor and cytokine concentrations obtained by different collection systems. *Int J Mol Sci.* 2017;18(2):408. doi:10.3390/ijms18020408
54. Qu Q, Zhou Y, Shi P, et al. Platelet-rich plasma for androgenic alopecia: a randomized, placebo-controlled, double-blind study and combined mice model experiment. *J Cosmet Dermatol.* 2021;20(10):3227–3235. doi:10.1111/jocd.14089
55. Gressenberger P, Pregartner G, Gary T, Wolf P, Kopera D. Platelet-rich plasma for androgenetic alopecia treatment: a randomized placebo-controlled pilot study. *Acta Derm Venereol.* 2020;100(15):adv00247. doi:10.2340/00015555-3609
56. Giordano S, Romeo M, Lankinen P. Platelet-rich plasma for androgenetic alopecia: does it work? Evidence from meta analysis. *J Cosmet Dermatol.* 2017;16(3):374–381. doi:10.1111/jocd.12331
57. Li C, Pan L, Yang L, Kong J, Zhang L. An umbrella review of the use of platelet-rich plasma in the treatment of androgenetic alopecia. *J Cosmet Dermatol.* 2023;22(5):1463–1476. doi:10.1111/jocd.15617
58. Yepuri V, Venkataram M. Platelet-rich plasma with microneedling in androgenetic alopecia: study of efficacy of the treatment and the number of sessions required. *J Cutan Aesthet Surg.* 2021;14(2):184–190. doi:10.4103/0974-2077.323638
59. Maria-Angeliki G, Alexandros-Efstratios K, Dimitris R, Konstantinos K. Platelet-rich plasma as a potential treatment for noncicatricial alopecias. *Int J Trichol.* 2015;7(2):54–63. doi:10.4103/0974-7753.160098
60. Garg S, Manchanda S. Platelet-rich plasma-an ‘Elixir’ for treatment of alopecia: personal experience on 117 patients with review of literature. *Stem Cell Investig.* 2017;4:64. doi:10.21037/sci.2017.06.07

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