

The use of botulinum toxin in the treatment of androgenetic alopecia

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DEAR EDITOR,

Androgenetic alopecia (AGA) is the most common type of hair loss worldwide [1, 2]. In men, the likelihood of developing AGA increases with age: nearly 50% will experience AGA by age 50, and up to 80% by age 70 [1, 3]. The underlying mechanism involves the miniaturisation of the hair follicle, transforming hair into vellus hair [1]. The process includes microinflammation of the hair follicle leading to gradual perifollicular fibrosis, pathological hair follicle hypersensitivity to circulating androgens, in particular dihydrotestosterone (DHT), produced from testosterone by 5 α -reductase, and periapical muscle disorders [4, 5].

Treatment of AGA includes topical minoxidil and oral finasteride. New methods, like injecting botulinum toxin (BTX), are also being explored. BTX is already used in various dermatological and aesthetic treatments, such as hyperhidrosis, Raynaud's phenomenon, facial erythema, reducing facial and neck wrinkles, correcting a gummy smile or decreasing masseter muscles [6, 7]. There is limited research on BTX for AGA, highlighting the need for randomised clinical trials.

Analysed were articles from the PubMed database up to November 2022 using search terms "male pattern baldness", "androgenetic alopecia", or "hair loss", and "botulinum toxin" or "botox". Both authors independently selected relevant papers from the 227 articles, focusing on original studies investigating BTX in treating AGA and comparing it with other methods. Seven articles met the inclusion criteria.

A total of 265 patients aged 18–65 participated in these studies, including 49 women. Studies used the Hamilton–Norwood scale in five cases and the Ludwig scale

in one. BTX doses ranged from 30 to 150 units. Four studies assessed BTX alone, one compared it with LC Cell Hair Solution, one with a combination of BTX and oral finasteride, and one compared oral finasteride and topical minoxidil with and without BTX. In six studies, BTX was injected across the entire scalp, covering frontal, temporal, auricular, and occipital areas; one study treated half the scalp.

All studies that measured hair count in a selected scalp area reported a statistically significant increase. Subjective assessments rated the therapy as at least satisfactory in those studies where patient feedback was included. No severe side effects were noted; minor side effects included skin irritation, mild headache, swelling, and itching. Detailed data from these seven papers are presented in Table 1 [8–14].

The mechanism by which BTX treats AGA remains unclear. Hair follicle involution in AGA involves DHT, formed from testosterone via 5 α -reductase. The conversion of DHT to estradiol is oxygen-dependent [15]. In AGA-affected areas, they reduce blood flow and hypoxia, which result in higher DHT concentrations. By relaxing the scalp, BTX injections might enhance blood flow and oxygen delivery to hair follicles [8, 16]. Additionally, DHT-induced mediators such as DKK-1, interleukin-6, and TGF-1 contribute to AGA [17]. Research indicates that BTX can inhibit TGF-1 secretion in hair follicles, addressing the disease's underlying cause [11].

However, the reviewed studies have limitations, including small sample sizes and a lack of control groups, as noted in a 2022 review [18]. The long-term effects of BTX treatment beyond 60 weeks remain unknown. Future research should

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Table 1. The detailed description of research on treating androgenetic alopecia with botulinum toxin

Article	Study group	Methodology	Results	Comment
Freund et al. [8]	50 male patients aged 19–57 years	Two courses of injections with a 24-week interval with 150 units of botulinum toxin A in frontal, temporal, periauricular and occipital muscles (doses equally divided into 30 injection sites) Follow-up for 60 weeks — 12 weeks of run-in followed by two treatment cycles of 24 weeks The results were evaluated by measuring the number of hairs on a fixed area determined by the Canfield method	The trial was completed in 40 out of 50 men The response rate was 75% Mean hair counts showed a significant ($p < 0.0001$) increase of 18 per cent between baseline and week 48	The first study that evaluated treating AGA with BTX The protocol included more than one course of BTX injection Precise measurement method showing encouraging results Lack of control group No follow-up after the study
Singh et al. [9]	10 male patients aged 22–42 years	A single course on injections with 150 units of botulinum toxin A in frontal, occipital, temporal and periauricular muscles (doses equally divided into 30 injection sites) Efficacy was evaluated through photography, and patients performed self-assessment scoring Follow-up 24 weeks after the treatment	80% had good to excellent responses on the photographic assessment In self-assessment, 70% of the patients had good to excellent responses, 20% had a fair response and 10% showed poor responses	The study was based only on one course of BTX injection Small study group Lack of control group The measurement method was not objective, however, the results seem to be promising
Zhang et al. [10]	25 male patients aged 30–45 years	A single course of injections with 50 units of botulinum toxin A in frontal, temporal, periauricular and occipital muscles (in a minimum of 30 injection sites) Efficacy was measured with Derma-Expert MC760 (grease content) and hair count at each visit Follow-up after 3 and 6 months	The trial was completed in 24 out of 25 patients At 3 months, 37.5% of patients showed obvious hair regrowth ($> 10\%$ increase from baseline) At 6 months, this percentage rose to 45.8% Additionally, almost 80% of the patients showed a significant decrease in grease secretion after 3 months, which restored to normal after 6 months	The study was based only on one course of BTX injection Small study group Lack of control group No specific details about the hair count performed as an efficacy measurement
Shon et al. [11]	18 male patients; mean age of 49 +/- 6.5 years	Injections with 30 units of botulinum toxin A every 4 weeks for 24 weeks at 20 different sites on the balding scalp Efficacy was measured based on an unblinded phototrichogram image analysis Follow-up at 0, 12 and 24 weeks	The number of hairs significantly increased at week 24 ($p = 0.012$) but not at week 12 ($p = 0.803$) A comparison of the pre- and post-treatment photographs at week 24 showed significant improvement ($p = 0.031$)	Small study group Lack of control group Precise measurement of the treatment efficacy showing promising results The protocol included 6 courses of injections with BTX No long-term follow-up
Zhou et al. [12]	63 male patients were divided into two randomised study groups — the first received BTX injections (30 patients) and the second received BTX injections and oral finasteride (FNS); 33 patients	Both groups received 4 courses of injections with 100 units of BTX every 3 months for 12 months Injections were done in frontal, temporal, periauricular, and occipital muscles — 30 injection target sites, each 1.5–2 cm apart The second group received oral finasteride as well Follow-up was provided every 3 months, 4 times in total during and after completion of the treatment	Hair counts in both groups at all times were significantly higher compared with before treatment ($p < 0.05$) Hair counts in both groups increased gradually with the prolongation of the treatment time There was no significant difference in the efficacy of BTX and BTX + FNS groups	The results did not favour BTX, nor BTX + FNS treatment, nevertheless, in both groups, a significant increase in hair density was observed Precise measurement of hair count Small study, but randomised study groups No information about FNS dosage
Tian et al. [13]	37 male patients aged 20–51 years were treated with 5% minoxidil topically and 1 mg finasteride orally	One course of injection with 50 units of botulinum toxin A on one hemisphere of the head — contralaterally, injections with normal saline as a control Follow-up at 3 and 6 months after the treatment	The number of hair roots on the hemisphere injected with BTX was higher than on the control side 3 and 6 months after the treatment ($p < 0.05$) The effectiveness rate was assessed at 75.7% ($p > 0.05$)	The results show that BTX might improve the effects of standard treatment of AGA Small study group. Comparison of the treatment efficacy only on one hemisphere, instead of collecting a control group
Nassar et al. [14]	62 patients (13 males and 49 females) aged 18–65, were divided into two groups	In the first group, 50 units of BTX were injected into the frontal, temporal, periauricular, and occipital muscles The patients in the second group underwent a needle mesotherapy treatment with 1 mL of LC Cell Hair Solution in the frontal and lateral areas of the scalp once a week for eight consecutive weeks Follow-up for every 2 weeks for 6 months	There was a significant difference between baseline and 6 months in the Ludwig and Hamilton–Norwood scale in both groups with a highly significant difference in the LC group in both male and female patients	Comparison of injections BTX and LC Cell Hair Essence Randomised groups, but small study groups, especially females

AGA — androgenetic alopecia; BTX — botulinum toxin; FNS — finasteride

incorporate additional parameters such as hair follicle morphology for a more comprehensive assessment.

While initial findings are promising, definitive treatment recommendations cannot be made based on current data. Methodological disparities among studies underscore that controlled clinical trials must thoroughly evaluate BTX as an AGA treatment. Given the substantial impact of alopecia on the quality of life for both men and women, further research in this area is imperative.

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Conflict of interest

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REFERENCES

- Lolli F, Pallotti F, Rossi A, et al. Androgenetic alopecia: a review. *Endocrine*. 2017; 57(1): 9–17, doi: [10.1007/s12020-017-1280-y](https://doi.org/10.1007/s12020-017-1280-y), indexed in Pubmed: [28349362](https://pubmed.ncbi.nlm.nih.gov/28349362/).
- Nestor MS, Ablon G, Gade A, et al. Treatment options for androgenetic alopecia: efficacy, side effects, compliance, financial considerations, and ethics. *J Cosmet Dermatol*. 2021; 20(12): 3759–3781, doi: [10.1111/jocd.14537](https://doi.org/10.1111/jocd.14537), indexed in Pubmed: [34741573](https://pubmed.ncbi.nlm.nih.gov/34741573/).
- Severi G, Sinclair R, Hopper JL, et al. Androgenetic alopecia in men aged 40–69 years: prevalence and risk factors. *Br J Dermatol*. 2003; 149(6): 1207–1213, doi: [10.1111/j.1365-2133.2003.05565.x](https://doi.org/10.1111/j.1365-2133.2003.05565.x), indexed in Pubmed: [14674898](https://pubmed.ncbi.nlm.nih.gov/14674898/).
- Swerdloff RS, Dudley RE, Page ST, et al. Dihydrotestosterone: biochemistry, physiology, and clinical implications of elevated blood levels. *Endocr Rev*. 2017; 38(3): 220–254, doi: [10.1210/er.2016-1067](https://doi.org/10.1210/er.2016-1067), indexed in Pubmed: [28472278](https://pubmed.ncbi.nlm.nih.gov/28472278/).
- Martinez-Jacobo L, Villarreal-Villarreal CD, Ortiz-López R, et al. Genetic and molecular aspects of androgenetic alopecia. *Indian J Dermatol Venereol Leprol*. 2018; 84(3): 263–268, doi: [10.4103/ijdv.IJDVL_262_17](https://doi.org/10.4103/ijdv.IJDVL_262_17), indexed in Pubmed: [29595184](https://pubmed.ncbi.nlm.nih.gov/29595184/).
- Rho NK, Han KH, Kim HS. An update on the cosmetic use of botulinum toxin: the pattern of practice among Korean dermatologists. *Toxins (Basel)*. 2022; 14(5): 329, doi: [10.3390/toxins14050329](https://doi.org/10.3390/toxins14050329), indexed in Pubmed: [35622575](https://pubmed.ncbi.nlm.nih.gov/35622575/).
- He J, Wang T, Dong J. Effectiveness of botulinum toxin A injection for the treatment of secondary axillary bromhidrosis. *J Plast Reconstr Aesthet Surg*. 2017; 70(11): 1641–1645, doi: [10.1016/j.bjps.2017.06.037](https://doi.org/10.1016/j.bjps.2017.06.037), indexed in Pubmed: [28754234](https://pubmed.ncbi.nlm.nih.gov/28754234/).
- Freund BJ, Schwartz M. Treatment of male pattern baldness with botulinum toxin: a pilot study. *Plast Reconstr Surg*. 2010; 126(5): 246e–248e, doi: [10.1097/PRS.0b013e3181ef816d](https://doi.org/10.1097/PRS.0b013e3181ef816d), indexed in Pubmed: [21042071](https://pubmed.ncbi.nlm.nih.gov/21042071/).
- Singh S, Neema S, Vasudevan B. A pilot study to evaluate effectiveness of botulinum toxin in treatment of androgenetic alopecia in males. *J Cutan Aesthet Surg*. 2017; 10(3): 163–167, doi: [10.4103/JCAS.JCAS_77_17](https://doi.org/10.4103/JCAS.JCAS_77_17), indexed in Pubmed: [29403190](https://pubmed.ncbi.nlm.nih.gov/29403190/).
- Zhang Li, Yu Q, Wang Y, et al. A small dose of botulinum toxin A is effective for treating androgenetic alopecia in Chinese patients. *Dermatol Ther*. 2019; 32(4): e12785, doi: [10.1111/dth.12785](https://doi.org/10.1111/dth.12785), indexed in Pubmed: [30566260](https://pubmed.ncbi.nlm.nih.gov/30566260/).
- Shon U, Kim MH, Lee DY, et al. The effect of intradermal botulinum toxin on androgenetic alopecia and its possible mechanism. *J Am Acad Dermatol*. 2020; 83(6): 1838–1839, doi: [10.1016/j.jaad.2020.04.082](https://doi.org/10.1016/j.jaad.2020.04.082), indexed in Pubmed: [32339707](https://pubmed.ncbi.nlm.nih.gov/32339707/).
- Zhou Y, Yu S, Zhao J, et al. Effectiveness and safety of botulinum toxin type A in the treatment of androgenetic alopecia. *Biomed Res Int*. 2020; 1501893, doi: [10.1155/2020/1501893](https://doi.org/10.1155/2020/1501893), indexed in Pubmed: [32802833](https://pubmed.ncbi.nlm.nih.gov/32802833/).
- Tian K, Gao S, Jia Z, et al. A study of combination unilateral subcutaneous botulinum toxin a treatment for androgenetic alopecia. *J Cosmet Dermatol*. 2022; 21(11): 5584–5590, doi: [10.1111/jocd.15179](https://doi.org/10.1111/jocd.15179), indexed in Pubmed: [35751480](https://pubmed.ncbi.nlm.nih.gov/35751480/).
- Nassar A, Abdel-Aleem H, Samir M, et al. Efficacy of botulinum toxin A injection in the treatment of androgenic alopecia: a comparative controlled study. *J Cosmet Dermatol*. 2022; 21(10): 4261–4268, doi: [10.1111/jocd.14817](https://doi.org/10.1111/jocd.14817), indexed in Pubmed: [35100493](https://pubmed.ncbi.nlm.nih.gov/35100493/).
- Sansone-Bazzano G, Reisner RM, Bazzano G. Conversion of testosterone-1,2-3H to androstenedione-3H in the isolated hair follicle of man. *J Clin Endocrinol Metab*. 1972; 34(3): 512–515, doi: [10.1210/jcem-34-3-512](https://doi.org/10.1210/jcem-34-3-512), indexed in Pubmed: [5011255](https://pubmed.ncbi.nlm.nih.gov/5011255/).
- Goldman BE, Fisher DM, Ringler SL. Transcutaneous PO2 of the scalp in male pattern baldness: a new piece to the puzzle. *Plast Reconstr Surg*. 1996; 97(6): 1109–1116; discussion 1117, doi: [10.1097/0006534-199605000-00003](https://doi.org/10.1097/0006534-199605000-00003), indexed in Pubmed: [8628793](https://pubmed.ncbi.nlm.nih.gov/8628793/).
- Kwack MiH, Ahn JiS, Kim MK, et al. Dihydrotestosterone-inducible IL-6 inhibits elongation of human hair shafts by suppressing matrix cell proliferation and promotes regression of hair follicles in mice. *J Invest Dermatol*. 2012; 132(1): 43–49, doi: [10.1038/jid.2011.274](https://doi.org/10.1038/jid.2011.274), indexed in Pubmed: [21881585](https://pubmed.ncbi.nlm.nih.gov/21881585/).
- English RS, Ruiz S. Use of botulinum toxin for androgenic alopecia: a systematic review. *Skin Appendage Disord*. 2022; 8(2): 93–100, doi: [10.1159/000518574](https://doi.org/10.1159/000518574), indexed in Pubmed: [35415183](https://pubmed.ncbi.nlm.nih.gov/35415183/).