CASE REPORT
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Androgenetic alopecia in woman treated with botulinum toxin

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ABSTRACT

Background: Androgenetic alopecia (AGA) is the most common type of alopecia. AGA in women is called Female Pattern Hair Loss (FHPL). FHPL occurs in 50% of adolescence women.

Case Description: A 29-year-old woman presented with hair thinning on the top of her head in the last 3 years. Dermatological status in the parietal region showed a diffuse and ill-define patch of alopecia, and hair thinning was found along the midline of the scalp. The hair pull test in frontal, temporal, and parietal regions was negative. The Severity of Alopecia Tool (SALT) score is 10, and patient belonged to stage 2 according to The Sinclair Scale. Dermoscopy examination revealed scattered white dots over the vertex of the scalp with various hair diameters. Miniaturized hair and vellus hair were found in several areas. The ratio of terminal to vellus hair was 20:6 or 3:1. Injection of 100-unit botulinum toxin in the alopecia area was done every 3 months. After 1 month of treatment, the hair thinning was reduced.

Conclusion: Appropriate treatment will affect the prognosis of AGA patients. Appropriate treatment that based on the pathophysiology of the disease and the patient's genetics will provide a good therapeutic response.

Keywords: alopecia androgenetic, female pattern hair loss, botulinum toxin.
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INTRODUCTION

Alopecia or hair loss that may affect both men and women. Androgenetic alopecia (AGA), telogen effluvium, and alopecia areata are the three most common types of hair loss. Among any other types of hair loss, AGA is the most frequent type in dermatology practice. AGA or pattern baldness is a non-scarring alopecia characterized by progressive miniaturization of hair follicles and affects up to 80% men and 50% women. Prevalence of AGA increases with age. In men, this condition is also known as male-pattern baldness. While in women it is called female pattern hair loss (FHPL).[1]

There is no epidemiological data on the incidence of AGA in Indonesia. In January 2018 - January 2021, 6 cases of AGA were recorded at the Dermatology and Venereology Polyclinic, Sanglah Hospital Denpasar, which 3 cases were men and the other 3 were women.[2]

The role of androgens as an etiologic factor is less clear in women than in men. Until today, no genetic locus has been identified to be associated with FPHL. Several theories suggest that micro-inflammation in the hair follicles and abnormality of the arrector pili muscles may play a role in the pathogenesis of hair follicle miniaturization.[3]

History taking, physical examination, and supporting examinations such as dermoscopy and histopathology can be done to help diagnose AGA. It is important to develop more effective therapeutic modalities to treat AGA as baldness may reduce patient's quality of life. Therapeutic modalities such as minoxidil and finasteride still showed a low rate of clinical improvement in some patients with AGA. Type A botulinum toxin is the newest modality used for AGA therapy. Type A botulinum toxin may cause muscle relaxation and improve blood flow and end up to an improvement of hair follicle miniaturization.[4] We reported a case of AGA in women treated with botulinum toxin.

CASE REPORT

A 29 years old woman presented with progressive hair thinning in the last 3 years. The hair thinning began from the central scalp and gradually became wider since 6 months prior. Patient also experienced oily scalp without dandruff. History of dyeing or hair styling was denied. Patient denied emotional stress before onset of hair loss. The patient's mother had a history of the same complaint. Patient already use hair tonic containing minoxidil but no improvement was observed.

Vital and general examinations were within normal limits. Dermatological status in the parietal region showed a diffuse and ill-define patch of alopecia and hair thinning was found along the midline of the scalp. No scaling, erythema, or cicatricial tissue were found. The hair pull test in the frontal, temporal, and parietal

regions was negative. The Severity of Alopecia Tool (SALT) score was 10, and patient belonged to stage 2 according to The Sinclair Scale (**Figure 1**).

Dermoscopy examination revealed scattered white dots (yellow arrows) in the vertex area of the scalp. The hair was found to be varied in diameters. Miniaturized hair (red arrow) and vellus hair (green arrow) were visible in several area. The ratio of terminal to vellus hair was 20:6 or 3:1 (**Figure 2**).

Based on the history taking, physical, and supporting examination, patient was diagnosed with androgenetic alopecia (female pattern hair loss). Injection of 100-unit botulinum toxin in the bald area was done every 3 months to treat this condition. Preparation for injection of botulinum toxin, 30 points were marked on the patient's head with a distance of 2 cm and spread over the frontal, periauricular, temporal and occipital areas. The injection was performed intramuscularly with a depth of 3 mm as much as 0.1cc or 3.3 units of botulinum toxin type A at each point. After one month, improvement was observed but patient still complaint of hair loss in some area. Complaints of pain, swelling, or redness in the injection area were denied.

Dermatological examination of the parietal region revealed a diffuse and ill-defined patch of alopecia. Hair thinning along the midline of the scalp had decreased. No scaling, erythema, or cicatricial tissue were found. The hair pull test was negative, the SALT score was 4, and patient was still belonged to stage 2 according to The Sinclair Scale (**Figure 3**)

Dermoscopy examination revealed scattered white dots (yellow arrows) in the vertex of the scalp area The hair was found to be varied in diameters. Miniaturized hair (red arrow) and vellus hair (green arrow) were visible in several places. The total ratio of terminal and vellus hairs was 40:5 or 8:1 (**Figure 4**).

DISCUSSION

Androgenetic alopecia is a hair disorder that may affect both men and women. The onset of FPHL or AGA in women is mostly during the reproductive years. FPHL

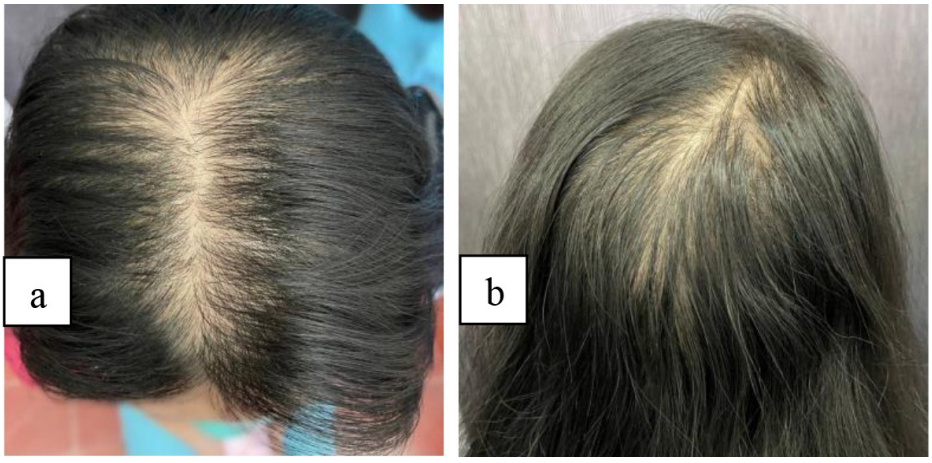

Figure 1. Diffuse alopecia in the parietal region a) top view b) rear view

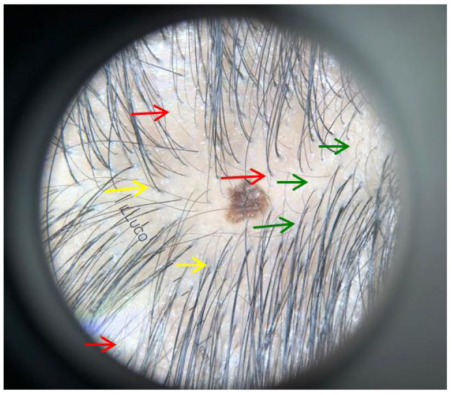

Figure 2. Dermoscopy of the vertex area of the scalp

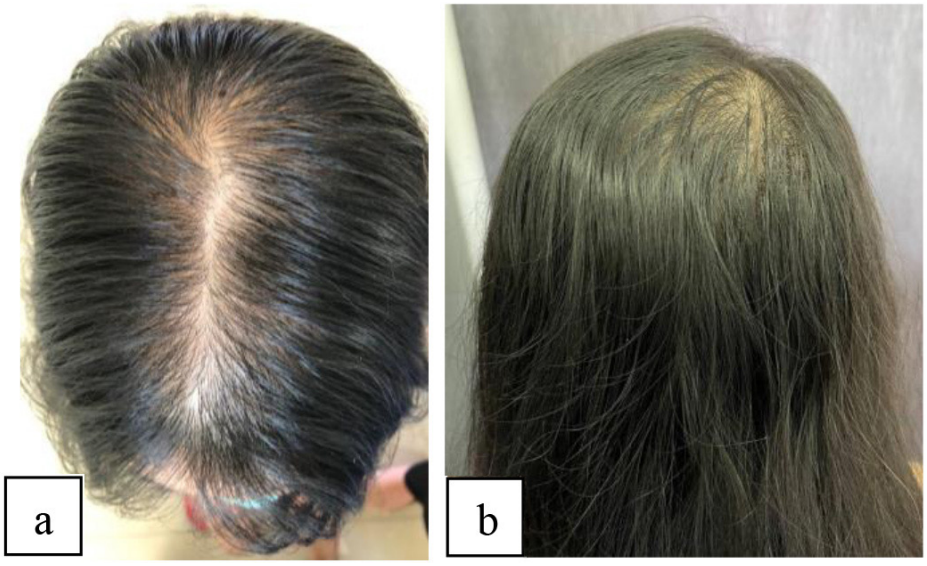

Figure 3. Improved diffuse alopecia in the parietal region a) top view, b) rear view

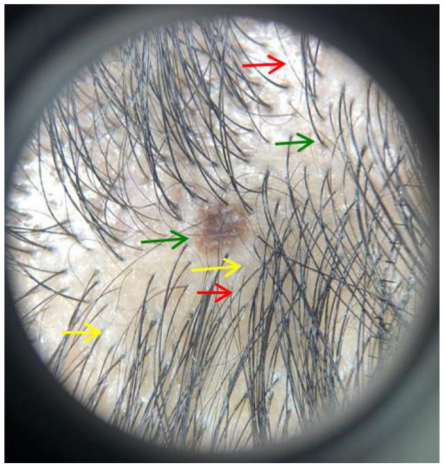

Figure 4. Dermoscopy of the vertex area of the scalp after therapy

is inherited in an autosomal dominant manner, 40-45% patients with FPHL have a family member who also experience the same complaints.[5] In this case, the patient was a woman of reproductive age who had hereditary factors from the family.

The pathogenesis of AGA is still debated. The consensus state that AGA is genetically mediated and influenced by androgens and dihydrotestosterone (DHT). DHT will attaches to the androgen receptor after free testosterone is converted via the type II enzyme 5-alpha reductase (5-αR2).[9] When DHT accumulates in tissues, the tissues will express higher activity of Reactive Oxidative Species (ROS) and ROS will increase transforming growth factor-β1 production (TGF-β1). TGF-β1 will mediate higher expression of androgen signaling protein in skin. High levels of cytokines such as IL-1α, IL-1β, and TNF-α may also cause higher androgen response. Increase of TGF-β1 and other inflammatory factors also will cause calcification of blood vessel and leads to arrector pili degeneration. This condition may also cause perifollicular fibrosis which end up in restriction of hair growth space and thickening of the dermal sheath which lead hypoxia of hair follicles.[6] In this case, patient presented with hair thinning without a hair loss in the last 3 years. This is consistent with the pathophysiology of AGA where hair thinning occurs due to hair miniaturization and not due to hair loss.

The diagnosis of AGA is made based on history taking, physical examination, and supporting examination. In AGA, the typical complaint is chronic hair loss with classic pattern of hair thinning in frontal, parietal, or vertex areas.[7] Hair pull test is a simple method to assess the severity of hair loss. Hair pull test should be performed on 3 different areas of the head. After grasping about 60 hairs between the thumb, index, and middle fingers, the hair is then pulled gently but firmly. The results of the examination are negative if there are less than 6 hair loss and positive if there are more than 6 hair loss. In patients with AGA, the results are commonly negative.[8] In this case, the history and physical examination supported the diagnosis of AGA and the results of the hair pull test in 3 areas were negative.

Dermoscopy examination can be performed to help diagnose AGA. White dots (WD) due to empty follicular ostia, yellow dots (YD) which are hypertrophied sebaceous glands, differences in hair diameters, miniature hairs, and vellus hairs are the typical findings of AGA.[9,10] Ratio of terminal hairs to vellus on 1 dermoscopy field is usually <4:1 on AGA and >7:1 on normal scalp.[9] In this case, dermoscopy results were consistent with the theory.

Severity of AGA in women can be determined by the Sinclair scale. The severity is divided into 5 such as stage 1 or normal state, stage 2 if there is widening of the middle part of the scalp, stage 3 if there is widening of the middle part and loss of lateral volume, stage 4 if the baldness in the anterior part, and stage 5 if there is advanced hair baldness.[1] The severity of alopecia also can be assessed with the Severity of Alopecia Tool (SALT) score. SALT divided hair loss into S_0 (no hair loss), S_1 (25% hair loss), S_2 (25-49%), S_3 (50-74%), S_4 (75-99%), and S_5 (100%).[1] In this case the patient belonged to stage 2 according to Sinclair Scale and the SALT score was 4. The Sinclair scale and SALT score in this case were used to monitor the outcome of therapy. In this case, the Sinclair's and Salt's scores were still the same after 1 month of therapy, but there was significant improvement on global radiographs and trichoscopy. We can monitor the results of therapy more accurately after 3 months of therapy.

Currently, AGA treatment includes systemic drugs (such as finasteride), topical medications (such as minoxidil), and other alternative methods (hair transplantation, platelet-rich plasma, and low-energy lasers). However, oral medications require long-term use and show a wide range of side effects. Topical treatments have limited efficacy and invasive treatments may cause some surgery complication.[5]

Botulinum toxin is a neurotoxin produced by the Clostridium botulinum bacteria. In some studies, botulinum toxin has been found to relax the muscles around the head, thereby increasing blood flow and oxygen concentration in the alopecia area, and further inhibiting DHT activation.[11] High oxygen concentrations can stimulate hair follicles into the growth phase, resulting in hair regeneration. In a study conducted by Zhou et al showed that treatment of androgenetic alopecia with botulinum toxin A significantly increased the number of patients hair and found that hair density also increased significantly after each treatment.[4] The type of botulinum toxin that is often used for AGA therapy is strain A.[12] In this case, type A botulinum toxin is used with the consideration of avoiding the side effects of facial paralysis that can occur in injections of the frontal area, providing a longer effect on tissues so that the time needed for hair growth is better. After 1 month of botulinum toxin A injection, patient showed a positive result.

CONCLUSION

Appropriate treatment will affect the prognosis of AGA patients. Appropriate treatment, based on the pathophysiology of the disease and the patient's genetics will provide a good therapeutic response.

CONFLICT OF INTEREST

The authors declare no competing interest in this study.

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None

AUTHOR CONTRIBUTIONS

HW made significant contribution to the design, acquisition and write up of the work. KW contributed to the revision of the work. KW approved the final work. HW and KW agreed to be accountable for all aspects of the work in ensuring that question related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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