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Adolescent Androgenic Alopecia

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Adolescent androgenic alopecia is pattern hair loss occurring in boys and girls younger than 18 years, whereas early-onset androgenic alopecia refers to pattern hair loss before 35 years of age. A number of studies published in the last decade have helped to elucidate the prevalence of adolescent androgenic alopecia, have clarified the genetic as well as physiologic mechanisms underlying hair loss, and have revealed the associated psychologic and systemic morbidities. This article provides an overview of the pathophysiology, diagnosis, and treatment of adolescent androgenic alopecia.

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Androgenic alopecia encompasses both male and female pattern hair loss and is a common form of hair loss in both men and women. The prevalence of androgenic alopecia varies in different populations.[1-3] Its onset usually occurs in the third or fourth decades of life in men, with later onset in women.[1,2,4] Androgenic alopecia does occur, however, in the pediatric population with hair loss seen as early as 6 years of age; on average, adolescent androgenic alopecia presents between 13.5 and 15 years of age.[5-7] It is suggested that adolescent androgenic alopecia is the most common cause of adolescent hair loss,[6] with 1 study reporting approximately 15% (77/496) of adolescent boys aged 15 to 17 years with stage 2 or greater hair loss on the Hamilton-Norwood grading scale.[8]

Androgenic alopecia causes considerable psychosocial distress in both males and females.[9-12] Individuals with androgenic alopecia experience increased levels of stress, decreased sense of physical attractiveness, and poorer self-esteem than controls without hair loss,[9] and they have been shown to appear older and less attractive to members of the opposite sex.[13] The patients most distressed by hair loss tend to be those who are more socially self-conscious and those who have considerable investment in their appearance.[9] Given that adolescents place substantial value on physical appearance and often are the victims of teasing based on physical appearance,[14] it follows that adolescents with androgenic alopecia should be at increased risk for experiencing the negative psychosocial impacts that can accompany hair loss.

Pathophysiology

Normal hair follicles undergo a 3-phase cycle characterized by a period of growth called the anagen phase, a period of involution called the catagen phase, and a period of rest called the telogen phase after which the hair is shed and a new anagen phase commences. Regulatory control of each phase of the follicular cycle is exerted by various hormones, most importantly androgens, and through interaction of dermal papillae with the germ cells of the hair follicle.[15,16] The length of the anagen phase varies among individuals, but at any given time, approximately 85% to 90% of scalp hair follicles are in the anagen phase.[15]

In patients with androgenic alopecia, the hair follicle continues to go through the 3 phases of development; however, there is a decrease in the duration of the anagen phase, increase in the duration of the telogen phase, and miniaturization of the hair follicle. One study revealed that these changes are mediated by inhibitory autocrine factors released by dermal papillae cells, likely in response to activation of androgen receptors by androgenic hormones.[16] Consistent with this idea, other studies have shown that patients with androgenic alopecia have increased levels of androgen receptor present in the dermal papillae of frontal hairs (where hair loss is occurring) compared with occipital hairs (where hair loss is absent).[17,18] It also has been shown that men and

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women with androgenic alopecia have increased levels of 5α-reductase, an enzyme important in converting testosterone to the more potent androgen dihydrotestosterone, in balding portions compared with nonbalding portions of the scalp.[17] These studies compliment the idea that increased levels of the androgen dihydrotestosterone interact with increased levels of androgen receptor in dermal papillae cells to cause the release of inhibitory autocrine factors that cause changes in the hair follicle leading to the replacement of large pigmented terminal hairs with small achromic vellus hairs. Several genes, including the androgen receptor gene, *AR*; the ectodysplasin A2 receptor gene, *EDA2R*; and the aldolase gene, *ALD*, which are all located on the X chromosome, have been implicated in the pathogenesis of androgenic alopecia. However, genetic mutations at autosomal genes also are suspected to play an integral role.[19-21]

Clinical Features

Adolescent androgenic alopecia differs from adult androgenic alopecia. Adolescents tend to have milder forms, with stage 1 hair loss on the Ludwig scale (general thinning at the center part) predominating for girls and stage 2 hair loss on the Hamilton-Norwood scale (frontotemporal recession with sparing of the vertex) predominating for boys. In addition, boys tend to have a greater incidence of female pattern hair loss, defined by diffuse thinning with preservation of the frontal hairline, with multiple studies reporting a 20% to 33% incidence of female pattern hair loss in male adolescents with androgenic alopecia.[5,6] Adolescents with androgenic alopecia also have been found to have a much higher incidence of family members with androgenic alopecia, with 72% to 83% of adolescent patients with androgenic alopecia having a first- or second-degree relative with androgenic alopecia.[5-7]

Differential Diagnoses

When making the diagnosis of adolescent androgenic alopecia, one must consider alternative diagnoses such as telogen effluvium and diffuse alopecia areata. Evidence for telogen effluvium consists of a positive hair pull test with more than 6 hairs removed from the head when the hair is firmly pulled between the forefinger and thumb, as well as a history of endocrine abnormalities or changes in the patient's health or stress level 2 to 3 months prior to the onset of hair loss.[22] Diffuse alopecia areata is an immune-mediated hair loss that can present with asymmetric patterns of scalp hair loss, with loss of hair of the eyebrows and other parts of the body, and with diffuse pitting and longitudinal striations of the nails.[22,23] Lack of these findings in an adolescent with a family history of androgenic alopecia should strengthen the clinician's suspicion of adolescent androgenic alopecia.

Diagnosis

Diagnosis of androgenic alopecia usually is made on clinical grounds, though dermatoscopy and biopsy can be helpful at times. Dermatoscopy reveals diversity in hair diameter[24] along with nonscarring hair loss with preservation of the ostia,[22] while histopathology, though usually unnecessary, documents an increased density of vellus and telogen hairs, a decrease in the telogen to vellus hairs ratio (from a 7:1 ratio to approximately a 2:1 ratio), and presence of follicular fibrous tracts, and superficial perifollicular inflammation.[25-27]

Systemic Associations

The diagnosis of androgenic alopecia in adolescents should prompt investigation of causes of hyperandrogenemia. Androgenic alopecia can be evident in conditions such as congenital adrenal hyperplasia and polycystic ovary syndrome (PCOS). One study investigating adolescent androgenic alopecia found that 3 of 19 girls carried a diagnosis of PCOS and 6 additional girls had clinical features, such as acne vulgaris, hirsutism, oligo-ovulation or anovulation, and polycystic ovaries, that suggested PCOS. This study also revealed that 1 of 25 boys had adolescent androgenic alopecia associated with late-onset congenital adrenal hyperplasia.[6]

There appears to be an association between androgenic alopecia and serious cardiovascular events, possibly linked by an increased risk for hyperinsulinemia and insulin-resistance–associated disorders such as obesity, hypertension, and dyslipidemia, in men with early-onset androgenic alopecia compared with age-matched controls.[28,29] Early-onset androgenic alopecia also has been proposed to be a clinical marker of insulin resistance.[29,30] The determination of metabolic syndrome and ultrasonography of the carotid arteries have been suggested as screening methods in male and female patients with early-onset androgenic alopecia to detect cardiovascular disease or for early preventive treatment.[31] It remains to be examined if adolescents with androgenic alopecia should undergo screening for insulin resistance, dyslipidemia, and early atherosclerosis.

Treatment

The mainstay of treatment of androgenic alopecia in adults includes oral finasteride and topical minoxidil. Finasteride, US Food and Drug Administration (FDA) approved for use in men only, is a 5α-reductase type II inhibitor that when given in a dosage of 1 mg daily has been shown to

increase the number of hairs as well as the weight of hair in men with androgenic alopecia.[32,33] Minoxidil is a potassium channel opener and vasodilator that is applied topically twice daily to the scalp and has been shown to increase the anagen phase of miniaturized follicles, leading to increased nonvellus hair count as well as increased patient perception of overall hair growth.[34-36] Minoxidil solution is available in 2% and 5% concentrations. Both solutions have shown efficacy in men and women with androgenic alopecia; however, the 2% solution is FDA approved for use in both men and women, while the 5% solution is FDA approved for use in men only.[34,35]

Treatment of adolescent androgenic alopecia has not been well-studied and currently there are no treatments that are FDA approved. In a study of 373 adolescents with androgenic alopecia who were treated with minoxidil for 18 months, 95% of patients responded to treatment, 54% reported improved scalp coverage, and 41% indicated slowing of further hair thinning.[37] Another study investigating adolescent androgenic alopecia found that 4 of 6 girls and 18 of 23 boys treated for more than 6 months with minoxidil solution 5% showed stabilization of hair loss.[6] Although none of these studies reported cardiovascular side effects with minoxidil use, there have been reports of tachycardia, palpitations, and dizziness occurring in alopecia areata patients treated with minoxidil solution 2%.[38] These reports illustrate the need for further testing to evaluate the safety and efficacy of minoxidil solution in the adolescent population. Finasteride oral therapy has not been evaluated in the adolescent population and its safety and efficacy in adolescent androgenic alopecia should be elucidated before becoming a recommended option.

Conclusion

Androgenic alopecia is the most common cause of adolescent hair loss and has the potential to negatively impact self-esteem and social functioning. Clinicians should be aware of the differential diagnoses for diffuse hair loss; the possible endocrine disorders that can present with androgenic alopecia; and the relationship between androgenic alopecia, cardiovascular events, and insulin resistance. The current treatment options for androgenic alopecia should be further evaluated in the adolescent population to ensure safety, verify efficacy, and establish a standard.

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