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Early-onset androgenetic alopecia and endocrine disruptors

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Abstract

Androgenetic alopecia (AGA) is the most common acquired non scarring alopecia in humans caused by androgen hormones in the setting of a genetic predisposition. Usually AGA starts after puberty, but recently it has been observed also in adolescents. Their mean age was 13 years with a slight prevalence in males. The premature AGA may be caused by environmental, alimentary (meat and milk) or cosmetic overexposure to sexual hormones or to endocrine disrupters (EDs). EDs are "exogenous substances that interfere with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body causing adverse effects to human health" and they are able to bind to the steroid hormone receptors.
Early onset AGA may be linked to the well known phenomenon of early puberty caused in some cases by hormones contained in food or by environmental chemicals. Therefore it is likely that the EDs may play a role also in the pathogenesis of early-onset AGA.

Introduction

Androgenetic alopecia (AGA) is the most common acquired non scarring alopecia that affects about 95% of men and more than 50% of women after the menopause. Clinically AGA is characterized by a gradual replacement of terminal hairs, in the central part of the scalp, by short and thin light hairs (vellus) under the influence of androgen hormones in the setting of a genetic predisposition. Essentially, androgens work by shortening the differentiative subphases (mostly anagen VI), leading to a progressive follicular miniaturization that results in vellus hairs. In addition, they probably delay the hair cycle by lengthening the kenogen phase. Kenogen is a phase of the hair cycle in which the shed telogen hair is not replaced by a new anagen hair leaving the follicle empty. Kenogen is a physiological phenomenon, the true resting phase of the cycle, observed also in infants, but lasts longer and is more frequent in AGA. The androgen effects on the target cells are mediated by multiple enzymes, such as:

- 5α reductase, which converts testosterone (T) in dehydrotestosterone (DHT),
- 3β-hydroxy-steroid-dehydrogenase, which converts dehydro-epiandrosterone (DHEA) and Δ5androstenediol in more powerful androgens as androstenedione and T,
- 17β-hydroxy-steroid-dehydrogenase, which converts androstenedione in T,
- aromatase, which converts androgens in estrogens.

Usually AGA starts being observed after puberty, namely in men in their late teens and in women years later, but recently it has been observed also in adolescents [1-4]. In this group, the mean age at onset is about 13 years and males were slightly prevalent. Sex hormone values are within normal limits, except DHEA-S that is increased in some cases [1, 2, 4]. Family history of alopecia is present in about 75% of the subjects. In some cases, the diagnosis is confirmed by histopathology [2, 4].
The premature AGA may be caused by environmental, alimentary (meat and milk) or cosmetic overexposure to sexual hormones or to endocrine disrupters (EDs).
In fact, early onset AGA may be linked to the well known phenomenon of early puberty. Back in 1985, in Puertorico, 2716 cases of precocious adolescence were described [5] as having fed with red meat that proved to contain high levels of estradiol. Indeed, the use, which is not illegal in all Countries, of estradiol, corticosteroids and testosterone in the breeding food for bovines, is still widespread. In addition estrogenic-like effects have been shown in other components of the diet [6].
As for EDs, they are exogenous substances that interfere with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body causing adverse effects to human health [7], for example by binding to steroid hormone receptors.
Chemicals commonly regarded as EDs include:

- pesticides, biocides (Dichloro-diphenyl-trichloroethane (DDT) or Polychlorinated biphenyls (PCB's), Polybrominated diphenyl ethers (PBDÈs) used as

industrial coolants and lubricants or in flame retardants for electronics tools,
- plastic food containers (phenols, phthalates),
- additives, solvents, heavy metals (Pb, Hg, Cr, As), regularly present in our houses,
- preservatives (parabens) in cosmetics,
- sunscreens (which are supposed to have some estrogenic effects at least in rodents)

Other substances may be considered as EDs:
- soja phytoestrogens (estrogenic substances from plants) and mycoestrogens (estrogenic substances from fungi).
- and, of course, zoo technical anabolic substances (steroids, growth hormone, anti-hormones substances).

The mechanisms and effects of EDs are related to reproduction, breast development, neuroendocrinology, thyroid, metabolism and obesity, and cardiovascular endocrinology and even to cancerogenesis. It is reasonable, therefore, to presume their possible role also in the pathogenesis of early-onset AGA.

Discussion

Although it is difficult to show that EDs may cause human diseases, it should be considered that some populations are very susceptible to them, such as breast-fed babies or prepuberal children because their renal clearance may be immature. Subjects overexposed to these compounds because of their professional activities or dietary habits are at risk as well.

In conclusion as 15% of adolescents have early-onset of AGA [1] we should consider also the importance of EDs effects on humans.

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