Precocious puberty

Precocious puberty (pubertas praecox) is defined as an acceleration of the onset of puberty by more than 2.5 standard deviations from the mean value of its onset in the population. In other words, it is characterized by the onset of development of secondary sexual characteristics (breast augmentation, hair growth, voice changes, muscle growth, beard, and changes in body fat storage) **before a girl's 8th birthday or a boy's 9th birthday**. These children are initially taller than their peers, but their growth period is shorter. and their final height is lower.[1]

Early puberty (constitutional acceleration) is defined as the acceleration of the onset of puberty by 2–2.5 standard deviations from the mean age of its onset in the population, i.e., between 8 and 9 years for girls and between 9 and 10 years for boys. This is a variant of normal development.[1]

Classification

Incomplete forms

- Thelarche praecox, adrenarche praecox, rarely menarche praecox.

Complete forms

- **Central** (*pubertas praecox centralis*) - GnRH and gonadotropin-dependent
  - Premature activation of the hypothalamic-pituitary-gonadal axis
- **Peripheral** (*pseudopubertas praecox*) - GnRH and gonadotropin-independent
  - Premature production of sex hormones without stimulation from higher centers.[1][2][3]

Incomplete forms of precocious puberty

- They are relatively common and are considered as a variant of normal development.
- **Isolated premature thelarche** (premature breast development)
  - Usually in girls under 2 years of age, sometimes at birth
  - Causes: external source of estrogen (breastfeeding mothers, some foods containing hormones, endocrine disruptors in the environment, mother using cosmetics with hormonal extracts) or self-production of estrogens with slower onset of inhibition by feedback and central mechanisms, and perhaps increased tissue sensitivity to estrogens.
  - Transition to central precocious puberty is rare, and growth and final outcome are not affected.
- **Isolated premature adrenarche** (premature development of pubic and axillary hair)
  - Usually manifests at 6-7 years of age.
  - This condition occurs more often in obese children with hyperinsulinemia and in children who have undergone intrauterine growth retardation.
  - It is not accompanied by total biological acceleration.
  - In some girls, polycystic ovary syndrome manifests in adulthood.[1]

Complete forms of precocious puberty

- Signs include accelerated growth and bone maturation: psyche and behavior do not correspond to their age.
- Without treatment, the final height is reduced.[1]

Central (gonadotropin-dependent) precocious puberty

- This occurs in bout 0.6% of children and is much more common in girls.
- About half of the cases manifest before the age of 6.
- Involved organs: CNS (hypothalamus, pituitary gland)
- Hormone levels: FSH and LH are elevated (at pubertal levels) and sex hormones (estrogens/testosterone) are also elevated.
- Secondary sexual characteristics are present: symmetrically enlarged (pubertal) testicles/ovaries.
- Sexual development is always isosexual = consistent with biological sex.
- In girls, this condition is most often idiopathic (in 70-80%, sometimes with familial occurrence).
- In boys, the cause is mostly a known underlying condition (up to 65%).
- **Etiology**: idiopathic, CNS tumors (hamartoma, astrocytoma, adenoma, glioma, germinoma), inflammatory CNS diseases, head injuries, iatrogenic causes (radio-, chemotherapy, surgery), CNS malformations.[1]

Precocious pseudopuberty

- Involved organs: gonads, adrenal glands
- Hormone levels: FSH and LH are low (prepubertal), but sex hormones are increased.
- Secondary sexual characteristics are present.
- Sexual development can be isosexual (according to biological sex) or heterosexual (virilization in girls,

feminization in boys).
- **Etiology**:
  - Adrenal steroidogenesis blockade (congenital adrenal hyperplasia, CAH).
  - Testosterone/androgen producing tumors, which can be adrenal, ovarian, or testicular.
  - Tumors capable of producing gonadotropin/hCG
  - External hormonal sources of androgens/estrogens
  - Familial testotoxicosis: a rare AD disorder involving a mutation of the luteinizing hormone receptor, leading to premature isosexual pseudopuberty in boys in the first years of life.
  - McCune-Albright syndrome - isosexual premature pseudopuberty in girls with focal ovarian activation, fibrous bone dysplasia, skin spots (café au lait)
  - Ovarian cysts
  - Long-term untreated hypothyroidism.[1]

Diagnosis

- Age at which the first symptoms of puberty and their progression must be known. Growth dynamics, bone age, and the degree of sexual development are also essential in diagnosis according to Tanner.
- Serum levels of FSH, LH, estradiol/testosterone, TSH, fT4, DHEA, or DHEAS should be evaluated.
- GnRH or LH-RH test is used to detect central precocious puberty.
  - After stimulation, gonadotropin levels are elevated in central puberty, but remain low in pseudopuberty.
- Brain MRIs are useful to rule out an organic cause of central precocious puberty.
- US of the adrenal glands, testicles or uterus and ovaries is useful.
- Hormonal (functional) cytology of the vaginal mucosa is also used.[1]

Treatment

- Incomplete forms are not treated.
- Complete forms are treated according to the cause.
- Central precocious puberty: **gonadotropin-releasing hormone agonists** are used (blocking pituitary receptors for endogenous GnRH and thus stopping sexual development: slowing down bone maturation or closure of bone fissures). The best results are achieved when treatment is initiated before the age of 6. Treatment is stopped when the bone age usual for pubertal growth spurt is reached (i.e., at 12 years of age for girls and at 13 years of age for boys).
- Premature pseudopuberty - if causal treatment fails, the following can be used: *ketoconazole* to inhibit steroidogenesis, *spironolactone* to inhibit androgen receptors, and *tamoxifen* to inhibit estrogen receptors.[1]

Links

Related articles

- Endocrine diseases of the gonads • Estrogens • Gestagens
- Puberty • Pubertas tarda
- Disorders of sexual development

References

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