Delayed puberty
From Wikipedia, the free encyclopedia

Puberty is described as delayed puberty with exceptions when an organism has passed the usual age of onset of puberty with no physical or hormonal signs that it is beginning. Puberty may be delayed for several years and still occur normally, in which case it is considered constitutional delay, a variation of healthy physical development. Delay of puberty may also occur due to malnutrition, many forms of systemic disease, or to defects of the reproductive system (hypogonadism) or the body's responsiveness to sex hormones.

Contents

1 Normal timing
2 Evaluation
   2.1 Lateness
   2.2 Discordance
   2.3 Indications of specific disorders
3 Possible causes
4 Constitutional delay
5 Medical evaluation
6 Management
7 See also
8 References

Normal timing

Approximate mean ages for the onset of various pubertal changes are as follows. Ages in parentheses are the approximate 3rd and 97th percentiles for attainment. For example, less than 3% of girls have not yet achieved pubarche by 13 years of age. Developmental changes during puberty in girls occur over a period of 3 – 5 years, usually between 10 and 15 years of age. They include the occurrence of secondary characteristics beginning with breast development, the adolescent growth spurt, the onset of menarche – which does not correspond to the end of puberty – and the acquisition of fertility, as well as profound psychological modifications.

The normal variation in the age at which adolescent changes occur is so wide that puberty cannot be considered to be pathologically delayed until the menarche has failed to occur by the age of 18 or testicular development by the age of 20.

For North American, Indo-Iranian (India, Iran) and European girls
- Thelarche (breast development) 10.0y5m

For North American, Indo-Iranian (India, Iran) and European boys
- Gonadarche (testicular enlargement) 11.5y
Pubarche (pubic hair) 11y (8.5–13.5y)
- Growth spurt 11.25y (10–12.5y)
- Menarche (first menstrual bleeding) 12.5y (10.5–14.5y)
- Adult height reached 15.5y (?-?)

The sources of the data, and a fuller description of normal timing and sequence of pubertal events, as well as the hormonal changes that drive them, are provided in the principal article on puberty.

**Evaluation**

There are three indications that pubertal delay may be due to an abnormal cause.

**Lateness**

The first is simply degree of lateness: although no recommended age of evaluation cleanly separates pathologic from physiologic delay, a delay of 2–3 years or more warrants evaluation.

- In girls, no breast development by 13 years, or no menarche by 3 years after breast development (or by 16).
- In boys, no testicular enlargement by 14 years, or delay in development for 5 years or more after onset of genitalia enlargement.

A delay of two standard deviations has been proposed as a standard.[1]

**Discordance**

The second indicator is discordance of development. In most children, puberty proceeds as a predictable series of changes in specific order. In children with ordinary constitutional delay, all aspects of physical maturation typically remain concordant but a few years later than average. If some aspects of physical development are delayed, and others are not, it is likely that something is wrong.

- For instance, in most girls, the beginning stages of breast development precede pubic hair. If a 12 year old girl were to reach Tanner stage 3 pubic hair for a year or more without breast development, it would be unusual enough to suggest an abnormality such as defective ovaries.
- Similarly, if a 13 year old boy had reached stage 3 or 4 pubic hair with testes that still remained prepubertal in size, it would be unusual and suggestive of a testicular abnormality.

**Indications of specific disorders**

The third indicator is the presence of clues to specific disorders of the reproductive system.

- Malnutrition or anorexia nervosa severe enough to delay puberty will give other clues as well.
- Poor growth would suggest the possibility of hypopituitarism or Turner syndrome.
- Reduced sense of smell (hyposmia) suggests Kallmann syndrome.

**Possible causes**
Variation of normal (constitutional delay)

- In females, prolonged high level of physical exertion, *e.g.* from being an athlete
- Systemic disease, *e.g.* Inflammatory bowel disease, chronic renal failure
- Undernutrition *e.g.* anorexia nervosa, zinc deficiency
- Hypothalamic defects and diseases *e.g.* Prader-Willi syndrome, Kallmann syndrome
- Pituitary defects and diseases *e.g.* hypopituitarism
- Gonadal defects and diseases *e.g.* Turner syndrome, Klinefelter syndrome, Testicular failure due to mumps orchitis, Coxsackievirus B, irradiation, chemotherapy, or trauma. Testicular failure is treated with testosterone replacement,[2] Ovarian failure.[2]
- Absence or unresponsiveness of target organs *e.g.* androgen insensitivity syndrome, mullerian agenesis
- Other hormone deficiencies and imbalances, Endocrine disorders.[3] *e.g.* hypothyroidism, Cushing's syndrome
- Cystic fibrosis[4]
- Mutations in FSHB[5]
- Frasier syndrome[6]
- Various forms of congenital adrenal hyperplasia.[3]
- Gonadotropin, a deficiency resulting from a number of congenital and acquired abnormalities of the central nervous system
- Biedl-Bardet syndrome
- Brain tumors *e.g.* craniopharyngioma, prolactinoma, germinoma, glioma; diseases of hypothalamus, irradiation and trauma.

### Constitutional delay

Children who are healthy but have a slower rate of physical development than average have constitutional delay in growth and adolescence. These children have a history of stature shorter than their age-matched peers throughout childhood, but their height is appropriate for bone age, and skeletal development is delayed more than 2.5 SD. They usually are thin and often have a family history of delayed puberty. Children with a combination of a family tendency toward short stature and constitutional delay are the most likely to seek evaluation. They quite often seek evaluation when classmates or friends undergo pubertal development and growth, thereby accentuating their delay.

### Medical evaluation

Pediatric endocrinologists are the physicians with the most training and experience evaluating delayed puberty. A complete medical history, review of systems, growth pattern, and physical examination will reveal most of the systemic diseases and conditions capable of arresting development or delaying puberty, as well as providing clues to some of the recognizable syndromes affecting the reproductive system.

Since bone maturation is a good indicator of overall physical maturation, an x-ray of the hand to assess bone age usually reveals whether the child has reached a stage of physical maturation at which puberty should be occurring. Visible secondary sexual development usually begins when girls achieve a bone age of 10.5 to 11 years, and boys achieve a bone age of 11.5 to 12 years.

The most valuable blood tests are the gonadotropins, because elevation confirms immediately a defect of the gonads or deficiency of the sex steroids. In many instances, screening tests such as a complete blood count, general chemistry screens, thyroid tests, and urinalysis may be worthwhile.
More expensive and complicated tests, such as a karyotype or magnetic resonance imaging of the head, are usually obtained only when specific evidence suggests they may be useful.

Use of gonadotropin releasing hormone can be of value in the differential diagnosis.[7]

If delayed puberty is accompanied with a lack of sense of smell (anosmia) or a history of un-descended testicles (cryptorchidism) when born then a diagnosis of Kallmann syndrome could be considered.[8][9]

**Management**

If a child is healthy but simply late, reassurance and prediction based on the bone age can be provided. No other intervention is usually necessary. In more extreme cases of delay, or cases where the delay is more extremely distressing to the child, a low dose of testosterone or estrogen for a few months may bring the first reassuring changes of normal puberty.

If the delay is due to systemic disease or undernutrition, the therapeutic intervention is likely to focus mainly on those conditions.

If it becomes clear that there is a permanent defect of the reproductive system, treatment usually involves replacement of the appropriate hormones (testosterone/dihydrotestosterone for boys,[10] estradiol and progesterone for girls).

Pubertal delay due to gonadotropin deficiency is treated with testosterone replacement or with HCG [2]

Growth hormone is another option that has been described.[11][12]

Subnormal vitamin A intake is one of the aetiological factors in delayed pubertal maturation. Supplementation of both vitamin A and iron to normal constitutionally delayed children with subnormal vitamin A intake is as efficacious as hormonal therapy in the induction of growth and puberty.[13]

**See also**

- Endocrinology
- Menarche
- Precocious puberty
- Tanner stage
- Developmental milestones
- Hypogonadism
- Kallmann syndrome

**References**

good clinical status"
(anonymous publication).


"Delayed puberty and hypogonadism caused by
mutations in the follicle-stimulating hormone
β-subunit gene" (anonymous publication).

"Frasier syndrome: a rare cause of delayed puberty"
(anonymous publication).

of the gonadotropin releasing hormone test in
differential diagnosis of delayed puberty in
adolescents over 14 years of age]" (in German).

8. ^ Oxford Endocrinology Library. Testosterone


Categories: Endocrine gonad disorders | Gonadotropin-releasing hormone and gonadotropins | Pediatrics
Sexuality and age | Sexual health

- This page was last modified on 8 September 2012 at 15:02.
- Text is available under the Creative Commons Attribution-ShareAlike License; additional terms may apply. See Terms of Use for details.

Wikipedia® is a registered trademark of the Wikimedia Foundation, Inc., a non-profit organization.