

# Delayed puberty

Gary Butler

## Abstract

The onset of puberty is usually regarded as delayed at 13 years in girls and 14 years in boys. The initial approach requires a detailed history and clinical examination to exclude other medical or psychological problems. The presence or absence of pubertal signs should be documented. Investigations should be targeted at ruling out any medical causes and determining whether the delay is due to central gonadotrophin deficiency or a gonadal disorder. Physiological or constitutional delay is more common in boys but is a diagnosis of exclusion. Treatment may be given using low doses of sex steroids, testosterone or oestradiol initially in a short course of between 3 and 6 months, but continuing in escalating doses mimicking the normal course of puberty, watching regularly for the spontaneous resumption of progress and gonadotrophin secretion. Counselling, reassurance and support are key elements in the management of adolescents with delayed puberty.

**Keywords** gonadotrophin; Kallmann syndrome; menarche; oestradiol; puberty; testosterone

## What constitutes late or delayed puberty

There is a wide range in the timing, start and subsequent milestones of normal puberty so it is important to appreciate the considerable variability in healthy adolescents. Puberty normally starts with breast development in girls around age 11 years and is associated with rapid growth. If there are no signs of this happening in a girl over 13 years then further investigation is warranted. The lack of the appearance of breasts and an absent growth spurt is usually pretty obvious to girls and their families. Primary failure of menstruation by 16 years needs evaluating, but if the rest of puberty has been slow to occur, then late onset of menstruation is probably just part of slow normal development.

In boys the first signs of puberty are much more subtle. This is heralded by testicular enlargement which normally occurs at around 11–12 years. Very little else obvious occurs in the early stages and so these early signs are often not recognised by boys who think nothing is happening to their pubertal development. The peak growth spurt and other changes such as voice breaking, muscle bulking and facial hair growth usually do not appear for another two to three years. Most worried boys just have late normal puberty and clinical examination demonstrating growth of the testes is all that is needed for reassurance. No evidence of testis growth in a boy over 14 years constitutes delayed puberty.

A less common problem is the normal commencement of puberty but a subsequent halting with failure to progress or complete sexual development. This is delayed *progress* through puberty,

and is always worrying. It needs a thorough investigation along a similar thought process to that which delays the onset. The most common presenting example of this is secondary amenorrhoea. The full details of assessment are outside the scope of this review but measurement of the gonadotropins FSH and LH will point to a hypothalamic cause (if low) or an ovarian cause if high.

The new UK 2–18 and 2–20 year growth charts contain two zones defined by the three vertical black *puberty lines* (Figure 1). The first zone clearly defines the acceptable range for the onset of puberty in each sex. Failure to begin with any sign of development at an age beyond the middle line (age 13 years in girls and age 14 years in boys) defines puberty as delayed. Wording along this line reinforces this observation. The second zone delineates the normal age range for completing puberty. In girls the lack of menstruation is the defining feature of not completing puberty, and failure of the voice to fully deepen and for facial hair not to develop in boys are the obvious signs in boys that puberty has not progressed. The charts can therefore help detect the delayed onset *and* progress of puberty (Figure 2).

## When might delayed puberty be expected?

Delayed puberty may be due to an unrecognised chronic condition so the initial approach to investigation should always start from a general footing. Longstanding chronic childhood conditions may delay growth and puberty especially where inflammatory processes are present and corticosteroids have been used in the treatment regimen. Despite an obvious cause, pubertal assessment is necessary as active treatment of the delay in growth and puberty can improve the growth prognosis, reduce the long-term risk of osteoporosis and can boost self-esteem.

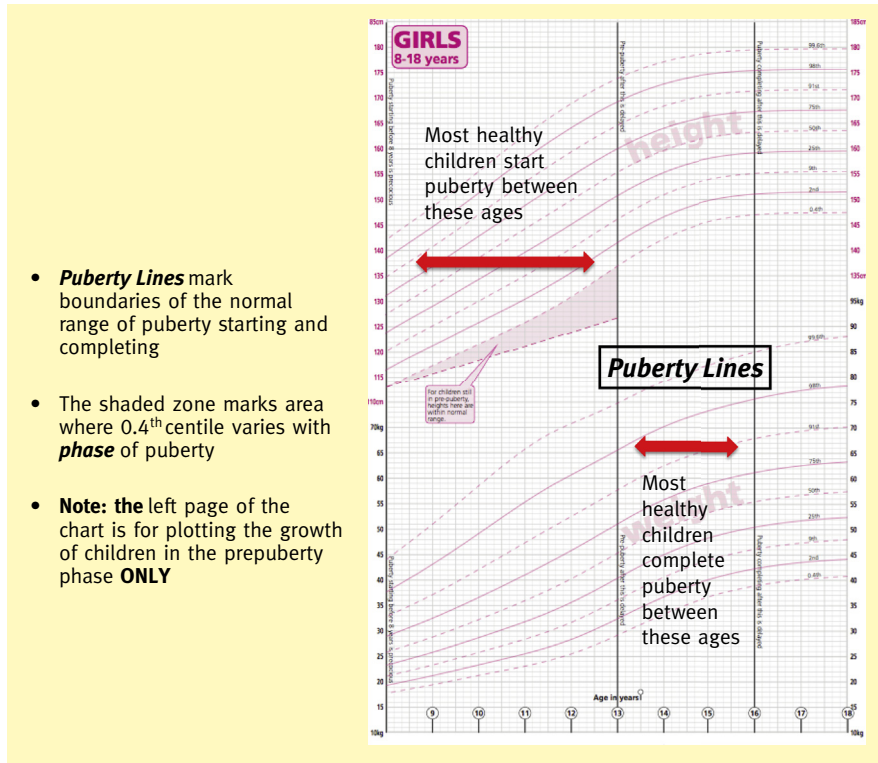
Monitoring pubertal progress is mandatory in all adolescents with chronic conditions as failure to progress through puberty may also be a sign of disease reactivation, poor adherence to medical treatment or the development of complications. Nonetheless, in regular clinical reviews of adolescent patients, repeated clinical examination to formally stage of puberty is neither acceptable nor desirable, so pubertal progress can be monitored through history taking with reference to the *phases of puberty* (Table 1). Should a problem be suspected, at that stage a clinical examination can be undertaken.

Detailed evaluation of the development of puberty may be made using the five Tanner stages where pre-puberty is Stage 1 and maturity is Stage 5. However, the simpler alternative to evaluating pubertal development is establishing whether the young person is in one of the three phases of puberty.

If clinical examination is not possible or desirable, then the puberty phase may be ascertained through simple questions about the appearance of the characteristics of sexual development for example breast development and menarche in girls, pubic hair development (in both sexes) and observation of parameters such as breaking of the voice and facial hair development in boys (Table 1).

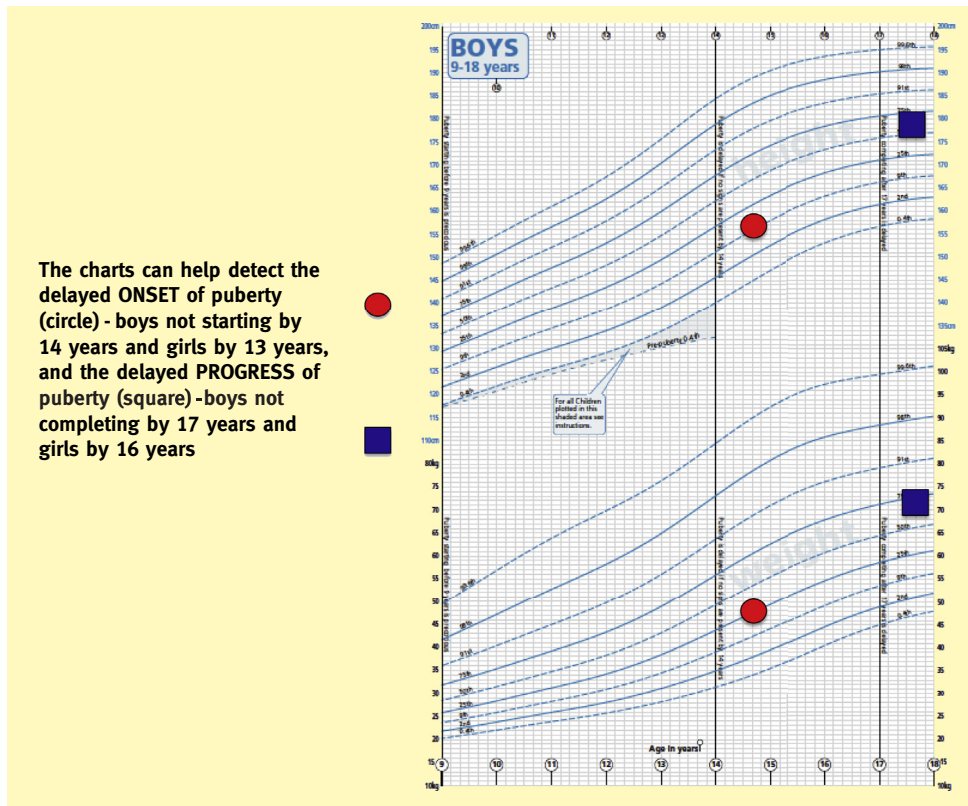
Simple or constitutional delay of puberty is often accompanied by growth delay and can be familial. So a detailed family history can be helpful, but this diagnosis should only be made when all other reasons for late puberty have been excluded (Table 2).

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- **Puberty Lines** mark boundaries of the normal range of puberty starting and completing
- The shaded zone marks area where 0.4<sup>th</sup> centile varies with **phase** of puberty
- **Note:** the left page of the chart is for plotting the growth of children in the prepuberty phase **ONLY**

**Figure 1 Puberty section of the UK 2–18 growth chart** © 2012/13 Royal College of Paediatrics and Child Health. Most children plotted to the left of the first puberty line will be prepubertal. Signs of puberty appearing earlier than this may indicate precocious puberty so an assessment will be necessary. Children with ages between the first two puberty lines will either be in **Pre-puberty (P)** or **In-puberty (I)**. If they have **Completed (C)** puberty (i.e. have adult sexual development) this may just be early normal pubertal maturation but it could also be abnormally rapid or precocious progression, so a review is indicated. Most adolescents with measurements lying between the second and third puberty lines will either be **In-puberty** or have **Completed** puberty. If there are **no** signs of pubertal development at all, then puberty is delayed and further assessment is necessary. Young adults with measurements plotted to the right of all three puberty lines will usually have **Completed** puberty. If this is not the case, this could mean pubertal progression is delayed and further assessment is needed.



**Figure 2 UK growth charts and detection of delayed puberty** © 2012/13 Royal College of Paediatrics and Child Health.

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