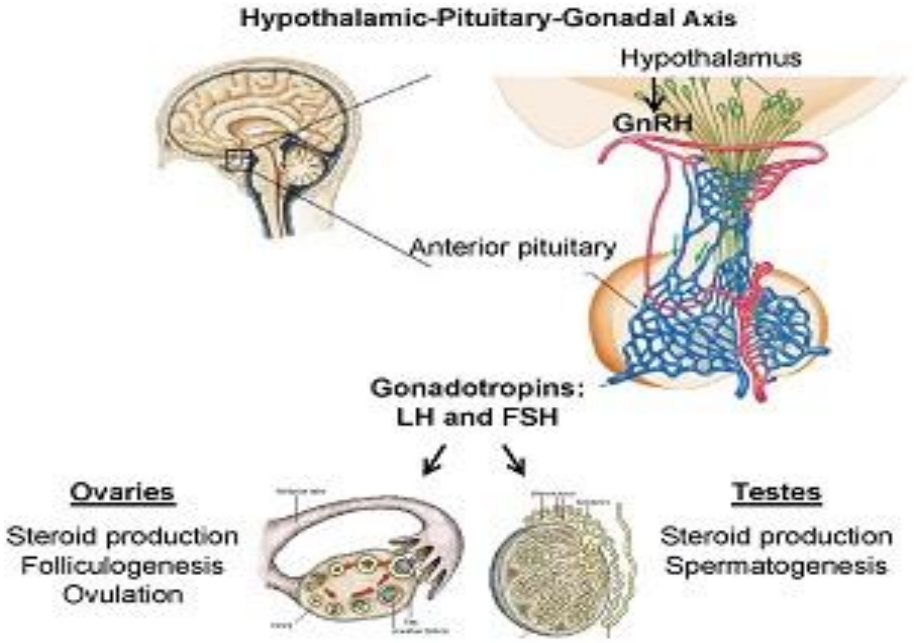
NHS
Southport and Ormskirk Hospital
NHS Trust

PATIENT INFORMATION

Variations of Pubertal Development

Hormones Affecting Puberty

Gonadotrophin Releasing Hormone (GnRH) is released by the hypothalamus and controls the release of luteinising hormone (LH) and follicle stimulating hormone (FSH) from the anterior pituitary gland. The release of this hypothalamic hormone is the most important control mechanism regulating pubertal development and fertility. Both LH and FSH act on the ovaries in girls or testes in boys, to initiate the release of oestrogen and testosterone. Oestrogen and testosterone are often referred to as sex hormones and they are responsible for the development of pubertal characteristics as well as changes in behaviour.



Growth During Puberty

Children grow at a relatively constant rate throughout childhood, until just before the start of puberty when the speed of growth (growth rate) slows down to its lowest point. After puberty starts, the growth rate rapidly increases, which is known as the ‘pubertal growth spurt’. The pubertal rapid growth phase or pubertal growth spurt, lasts for about 2

years, and starts around 2 years earlier in girls than in boys. During puberty the peak growth rate for girls is 6–11 cm per year starting at around 11.5 years of age. The peak growth rate for boys is 7–12 cm per year starting at around 13.5 years of age. After the pubertal growth spurt growth continues at a slow rate for several years, until the growth plates (the gaps at each end of the long bones, which allow the bone to grow) are fused and the bones cannot get any longer. For girls, most of their height is achieved after 18–24 months of having periods, at which time their skeletal development is mature and their growth plates are fused.

Bone age is a measurement of biologic age rather than actual or chronologic age. It is a useful measurement of an X-ray taken of the left hand and wrist which allows assessment of remaining growth potential for a child or adolescent. Measuring bone age allows the doctor to predict how much further growth is possible. For example if the bone age is younger than the actual or chronological age of the child, there is potential for more growth to occur

Normal Puberty

The early changes of puberty usually occur between the ages of 9-13 years. They are noticeable in girls by the budding of breasts and then pubic hair, with menstrual periods starting between 11–14 years of age. Boys usually develop testicular enlargement and then pubic hair (9–14 years). Underarm and facial hair and deepening of the voice occur typically between 13-16 years. It is when these changes begin earlier than 8 years in a girl and 9 years in a boy that an assessment needs to be made by a specialist paediatric endocrinologist to determine what the cause of the early pubertal development is.

Early Normal Puberty

In many countries children appear to be going through puberty at an age which is much younger than children in previous generations. This is called the secular trend in growth and development. The earlier age of puberty is probably due to the effects of improved nutrition and living circumstances. This seems to be particularly true for girls, with many girls showing early signs of breast development at 8 years of age. This means some girls will start to have menstrual periods while still in primary school. In most cases this early puberty is just a variation of normal. After assessment by a specialist paediatric endocrinologist, no specific treatment is usually required. The girl and her family need to have the situation explained, and if needed a child psychologist can help both the child and family.

True Early (Precocious) Puberty

True early precocious puberty means that the physical signs of puberty, i.e. breast development in girls, genital enlargement in boys, and the appearance of pubic hair occur at an earlier age than usual. In true precocious puberty the appearances of sexual development are identical to normal puberty, it is just that they occur earlier caused by raised LH and FSH hormones. The child may be taller than other children. The increase in height is due to a premature pubertal growth spurts and the bone age will be advanced. An X-ray of the left hand will determine this. It will indicate how much time remains for growth and allows an approximate prediction of final adult height. Although the child may be tall now, if the problem is not treated he/she may end up shorter than expected because of premature fusion of the long bones i.e. reduced time to the end of the growing period. This is a very important consideration when

deciding whether treatment is required. Should the specialist decide that the child would benefit from treatment it would be to stop or reverse puberty, i.e. breasts, pubic hair, periods etc, and hopefully preserve growing potential in the bones. Puberty that commences too early (and the same applies if puberty is very late) can also be associated with behavioural problems in both girls and boys as the individual child may be extremely distressed that he/she is different from their peer group.

The reason early puberty occurs is that the hypothalamus or pituitary gland signals the ovaries or testes to make female or male hormones at an earlier than usual time. In the majority of cases the cause of this is unknown. The condition may be caused by cysts or tumours at the base of the brain, however, this is very rare. It may be that the child's specialist advises that scans of the brain be taken in order to investigate this possibility. True precocious puberty is about twenty times more common in girls than in boys.

Other Rare Causes of Early Puberty

Early (precocious) puberty which is not caused by raised LH and FSH is more common in boys than girls, and in boys it is known as testotoxicosis. The testes develop on their own without stimulation from the pituitary gland. This rare condition tends to run in families and it is important to recognise because the treatment differs from true precocious puberty. The pattern or sequence of pubertal development is identical to that of true precocious or normal puberty. Gonadotrophin independent precocious puberty does occur in girls but only in association with the rare syndrome of abnormal bone development and skin

pigmentation called McCune Albright Syndrome. In this condition, boys can also develop early.

Treatment of Early Precocious Puberty

No treatment

In many cases of early precocious puberty, no treatment may be necessary. This is likely if the pubertal process is progressing slowly and/or the effect of early puberty on the child's final height will not be great. Explanation and supportive counselling maybe the only treatment required.

GnRH Analogues
(Gonadotrophin Releasing Hormone Analogues)

This is a synthetic or manufactured form of the small protein, which normally stimulates the pituitary gland, as a signal to enter puberty. When GnRH is used as a treatment, it over-stimulates and 'exhausts' the pituitary gland, until that gland completely stops making the sex hormones and the physical changes of puberty are reversed. GnRH treatment must be given regularly every month by injection to be effective. Treatment to put puberty "on hold" usually lasts until the child reaches the appropriate age for puberty when the functions of their own hormones are allowed to recommence. Generally speaking, treatment is stopped when a child enters secondary school. After stopping treatment, puberty will not suddenly advance but will progress at a normal rate. Sometimes, after years of puberty suppression, it may take many months for it to switch back on after treatment is ceased. There are no known serious side effects from GnRH analogue treatment. In some cases, headaches, nausea, vaginal bleeding or discharge have

been known to occur. All the available evidence is that the future fertility should be normal.

Premature Adrenarche

This is a self-limiting condition of pubic hair development, usually occurring between the ages of 6–9 years in both boys and girls. The pubic hair will remain until the rest of pubertal development (i.e. genital development in boys and breast development in girls), occurs later at an appropriate age. There may be an increase in the rate of growth along with a slight advancement of bone age. This is a normal pattern of adrenal development which requires no treatment. Occasionally this condition may be due to an underlying abnormality in the adrenal glands, but this is rare and the effects on a child are usually much more marked than in simple premature adrenarche. Occasionally, premature adrenarche can be associated with a later onset of polycystic ovary syndrome in teenage girls.

Isolated Premature Menarche

At the beginning of normal female puberty, the small amounts of oestrogen made by the ovary switch ‘on and off’. If enough lining of the womb is made with each ‘switch on’, there may be a small vaginal bleed when the ‘switch off’ occurs. This may happen several months in a row, and then disappear as total oestrogen increases and normal puberty progresses. It is a normal variant and usually needs no treatment. Before the diagnosis of premature menarche is accepted, all other causes of premature oestrogen secretion, and/or any local causes of vaginal bleeding must be eliminated by the specialist.

Delayed Puberty

Delayed puberty is defined as lack of any pubertal development by 13 years of age for girls and 14 years for boys. Delayed puberty is generally more of a clinical problem in boys than girls and certainly causes more problems with behaviour and self-esteem in boys than girls. Boys may be teased about lack of development or left out of attention from the opposite sex. Girls with delayed puberty may feel different and left out of discussions about periods and other topics of conversation in their peer group. These concerns may seem trivial but on occasions may lead to significant behavioural problems. The most common cause of delayed puberty is ‘constitutional delay’, a variant of normal puberty and growth whereby the bone age will be delayed, indicating that further growth is possible. Where there is a history of delayed puberty in parents, siblings or extended family it is known as ‘familial delay’. If there is no family history, it is known as ‘idiopathic delay’. If a hormone deficiency or chronic disease is causing the delayed puberty, then this underlying cause should be treated appropriately. It may be necessary to refer to a specialist paediatric endocrinologist for assessment and consideration of treatment with the appropriate sex hormone. In boys this may be in the form of an injectable testosterone preparation such as testosterone esters or testosterone enanthate for a short course; an alternative would be an oral androgen, such as testosterone undecanoate. In girls, oral oestrogen or transdermal oestrogen can be used.

Pubertal Gynaecomastia

Palpable or visible enlargement of glandular breast tissue is found in 40–50% of normal adolescent males. In most patients with gynaecomastia, no underlying pathological

cause is present; therefore, pubertal gynaecomastia needs to be considered as a normal variant of pubertal development. Pathological causes include Klinefelter Syndrome in which the testes are significantly smaller than in normal adolescent males. Other uncommon causes include partial androgen insensitivity. Lavender oil and tea tree oil, when used in skin-care products, have been associated with gynaecomastia. Drugs (such is digoxin, spironolactone, cimetidine, chlorpromazine and marijuana) may be associated with gynaecomastia. Soy products contain phytoestrogens and if consumed in large amounts can also cause gynaecomastia. There is no hormonal or medical treatment for pubertal gynaecomastia. Administration of testosterone, either orally or intramuscularly is ineffective. It may even worsen the problem because a small amount of administered testosterone is changed in body fat to oestrogens, thus aggravating the breast tissue development. Most boys with gynaecomastia can be given assurance that the condition will subside and nothing needs to be done. Most cases will resolve within three to four years. If gynaecomastia is marked or causing extreme psychological and emotional distress, referral to a reconstructive surgeon for a subareolar mastectomy (operation to remove breast tissue) is made post puberty.

Asymmetrical Breast Development

Asymmetrical breast development can occur in both males and females. In males, it is a variant of pubertal gynaecomastia. In females, breast development may be asymmetrical at the beginning of breast budding or subsequently through breast development. The degree of asymmetry can be quite marked. Consideration should be given to the possibility of an underlying chest wall or muscle

abnormality and examination should be conducted appropriately. However, in most cases asymmetrical breast development is just a physiological variant of puberty. In rare cases, an underlying vascular (blood vessel) abnormality or lipoma (benign fatty tumour) may cause one breast to appear larger than the other. This can usually be readily determined by a physical examination and by ultrasound.

Premature Thelarche

This is a self-limiting condition consisting of unilateral (one) or bilateral (both) breast development. It occurs usually in girls under 3 years of age and may continue from the breast development in the first few months of life which results from oestrogen in the mother's milk. There are no other signs of oestrogen effects and growth is normal. However, increase and decrease of breast size at monthly to six weekly intervals is common in this condition. This does not affect the timing of the other signs of normal puberty. Premature thelarche may result from the occasional formation of ovarian cysts and/or increased sensitivity of the breast tissue to oestrogen stimulation from apparently normal levels of oestrogen within the body. The importance of the correct diagnosis of premature thelarche is to distinguish this condition from precocious puberty. No treatment is necessary. Usually the condition ceases within a year or two with disappearance of the breast tissue. Growth and final height are unaffected. Puberty occurs at the normal time and fertility is thought to be normal.

NOTES

NOTES

During your contact with us, it is important that you are happy with your care and treatment. Please speak to a member of staff and/or the ward/department Sister/Charge Nurse if you have any questions or concerns.

MATRON

A Matron is also available during the hours of 9.00 to 5.00 pm Monday to Friday. During these periods, ward/department staff can contact Matron to arrange to meet with you. Out of hours, a Senior Nurse can be contacted via the ward/department to deal with any concerns you may have.

INFECTION CONTROL REQUEST

Preventing infections is a crucial part of our patients' care. To ensure that our standards remain high our staff have regular infection prevention and control training and their practice is monitored in the workplace. We ask patients and visitors to assist us in preventing infections by cleaning their hands at regular intervals and informing staff of areas within the hospital that appear soiled.

As a patient there may be times that you are unsure whether a staff member has cleaned their hands; if in doubt please ask the staff member and they will be only too happy to put your mind at ease by cleaning their hands so that you can see them.

SPECIAL INSTRUCTIONS

None

ANY CONDITION SPECIFIC DANGER SIGNALS TO LOOK OUT FOR

CONTACT INFORMATION:

Your own GP –
Children's Ward – 01695 656912/656612

OTHER USEFUL TELEPHONE NUMBERS/CONTACTS:

NHS 111
Stop Smoking Helpline (Sefton) - 0300 100 1000
Stop Smoking Helpline (West Lancashire) - 0800 328 6297

Please call 01704 704714 if you need this leaflet in an alternative format

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Please remember to complete the **attached** *Friends and Family Test*.
Alternatively, you can complete the *Friends and Family Test* on-line by going to:
southportandormskirk.nhs.uk/FFT
Thank you

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