



**British Society for
Paediatric Endocrinology
and Diabetes**

KLINFELTER'S SYNDROME

This condition was first described in 1942 by Klinefelter and others and in 1959 was shown to be due to an abnormality of the sex chromosomes. It is now known to be remarkably common, affecting one in a 1,000 males, many of whom do not know that they have the syndrome.

Cause:

Human cells contain 46 chromosomes, arranged in 23 pairs, one of each pair inherited from the mother and one from the father. One pair of chromosomes comprises the sex chromosomes, so called because one major function is to determine the sex of the fetus. In women the sex chromosomes are both X chromosomes but men have one X and one Y. Ova (eggs) normally contain only one X chromosome and sperm either one X or one Y. Occasionally, due to a genetic accident in which the chromosomes do not separate normally as the ovum or the sperm develops, two X chromosomes are left in an ovum or an X and a Y in a sperm so, if these are fertilised, the fetus will develop as a male with two Xs and one Y chromosomes instead of the usual XY. Such fetuses develop into males with Klinefelter's syndrome.

Features of the syndrome:

Boys with Klinefelter's syndrome are generally normal at birth and are seldom recognised in early childhood although the testes may be rather small and firm. In build they tend to be tall and long-limbed, especially in the legs, this build may become more obvious in puberty. At puberty male development occurs but it can sometimes be incomplete with inadequate development of the genitalia, musculature and beard. At puberty also some boys also have somewhat excessive breast development. The testes remain small and firm because the development of the "seminiferous tubules" (the structures in the testes in which the sperm is formed) is abnormal. The production of sperm is therefore absent or inadequate and men with Klinefelter's syndrome are infertile. Intelligence is generally within the normal range but there may be a tendency to some reduction in verbal IQ scores. It has often been stated that men with Klinefelter's syndrome are prone to have psychological and behavioural problems but population screening, in which all the men with Klinefelter's syndrome in a population are identified, has been reassuring, indicating that there is overall no significant difference in behaviour from normal men.



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Investigations:

The diagnosis is made by finding the typical XXY genetic constitution. In some men there may be a "mosaic" state in which some cells are XXY and others have a normal male XY pattern; as might be expected such men tend to have less features of the condition. From mid-childhood the testicular problem is reflected in blood tests by high levels of the hormones from the anterior pituitary gland in the head which control the function of the testes. Biopsy (removal of a very small piece of tissue) of the testes shows the failure of development of the seminiferous tubules but this is not needed to make the diagnosis.

Treatment:

Since this is a genetic condition present in all the cells of the body no cure is possible so treatment has to be addressed to the problems that can arise. The tall stature and long-limbed build is seldom sufficiently great to cause cosmetic or other problems. If male development at puberty is inadequate, additional male hormone can be given as capsules, injections or, recently, skin patches. If there is excessive breast development at puberty this can be completely corrected surgically. If special help with schooling or behaviour is needed this can be of course be arranged. Sadly, the infertility cannot be helped but couples now have the option of artificial insemination with donor sperm.

Outlook:

Although it is concerning to learn of all the possible features of this condition it is important to remember that they are seldom all present and that most affected men make very good adjustment and have successful and fulfilled lives with infertility the only major problem.