Turner Syndrome
A Guide for Parents and Patients


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CONTENTS

TURNER SYNDROME

The lack of, or abnormality of, the second X chromosome produces Turner Syndrome. It effects only girls. They are likely to be short and lack ovaries that function correctly. There are other physical features that are common to the condition, but rarely do all occur together in one child.

INTRODUCTION

This booklet is written for parents of children with Turner Syndrome who wish to know more about the condition. There are two booklets about Turner Syndrome. The second booklet concentrates on Turner Syndrome in adulthood, but you will probably find it helpful to read both. The quotes that we have included in this booklet are from girls with Turner Syndrome.

"It is a problem, not your whole life". Kylie aged 7 years

For many years the Child Growth Foundation has listened to families describe what the diagnosis of Turner Syndrome in their daughter has meant to them and how it has affected them and their whole family. Hopefully, this booklet, along with support and information from their specialist, will help parents to gain sufficient knowledge to enable them to understand how they can help their daughter with any difficulties that may arise. Some of what you read may not be appropriate for your child - it is simply our best effort to pass on the knowledge entrusted to us by parents and professionals which may help others. You will need to discuss the details of your child's management with your specialist, as every Turner Syndrome child is an individual.

WHAT IS TURNER SYNDROME?

Turner Syndrome was first fully described by an American, Dr Henry Turner in 1938. Turner Syndrome (TS) is a chromosomal condition affecting approximately 1 in 2,500 live female births. The diagnosis is confirmed by examination of the chromosomes from a blood sample (karyotype). Turner Syndrome is usually characterised by short stature and non-functioning ovaries leading to the absence of pubertal development and infertility. There is no increased risk of mental retardation in Turner Syndrome girls whose intelligence spans the normal range.

The physical features associated with Turner Syndrome may include webbing of the neck (extra folds of skin); nail abnormalities; puffy hands and feet; coarctation of the aorta (constriction or narrowing of the main artery from the heart which can be corrected with surgery). Feeding problems may occur in the early childhood years and there can be learning or behavioural difficulties which may need professional help. A full list of associated features is given at the end of the booklet.

It must be emphasised that some girls may have only one or two mild features of the syndrome while others may have several easily recognised ones.

"I think doctors should be more educated about Turner Syndrome so they will be able to diagnose it earlier and give the correct information'.

HOW IS TURNER SYNDROME DIAGNOSED?

Although the diagnosis is initially based on the characteristic physical signs, it is confirmed by a chromosome analysis (karyotype). A chromosome is a string of genes present in every cell in the body. Normally, each cell has twenty-three pairs of chromosomes, making a total of forty-six chromosomes. One of these pairs, the sex chromosomes, determines the gender of the foetus, ie. will the baby be a boy or a girl? In a boy, the sex chromosomes will be an X and a Y (46XY) whereas in girls there are two X chromosomes (46XX). In Turner Syndrome there will usually be only one X chromosome instead of two, so making forty-five chromosomes in total (45X0, the 0 representing the missing chromosome). The missing X has been lost sometime during cell division from either the mother's egg or the father's sperm. When the X chromosome is missing in all the cells this is often described as "classical Turner Syndrome". There are also a number of abnormalities of the second X chromosome that can produce Turner Syndrome.

Mosaicism

Sometimes the second X chromosome is missing from, or is abnormal in, only some of the cells in the body but not all. This is referred to as Turner Mosaicism (46XX/45X0) as some of the cells are normal and some are abnormal. These girls often have less obvious physical characteristics, but ovarian function and height will be affected as in the classical 45X0 Turner Syndrome.

"I was diagnosed at 11 years. I was lucky because my Mum knew someone who had a daughter with TS and that helped".

Each individual child requires her own personal assessment and advice about her management and treatment. Although it is very important that the karyotype is performed, knowing the differences in karyotypes influences treatment in only a small proportion (about 1%) of girls with Turner Syndrome. In this group the identification of a particle of a Y chromosome is essential in view of the additional risk this causes of developing an ovarian tumour. If a particle of Y chromosome is identified, the ovaries should be removed.

Apart from the non-functioning ovaries, it is important to know that the vagina and uterus (womb) are normal. However, as the ovaries will not be producing the sex hormone oestrogen, replacement oestrogen therapy will normally be required throughout

adolescence and adulthood for a variety of reasons including future sexual activity, for maintaining the strength of the bones and for psychological reasons.

The chromosomal abnormality leading to Turner Syndrome is an accident which, unfortunately, can not be prevented. The cause of the missing or damaged chromosome in Turner Syndrome is not known and no risk factors eg. mother's age, diet during pregnancy etc. have been identified. There is also no known increased risk of recurrence in any future pregnancy beyond that seen in the general population ie. 1 in 2,500 live born females. The equivalent of Turner Syndrome in boys (450Y) does not occur as survival following the loss of the X chromosome is not possible in males.

WHEN IS TURNER SYNDROME DIAGNOSED?

Diagnosis is possible at birth, or even before the baby is born. Sometimes there are features of Turner Syndrome that can be identified by ultrasound scan, the diagnosis is then confirmed through amniocentesis (removal of some of the fluid that surrounds the foetus) or chorionic villus sampling (part of the early placenta). These tests allow examination of the chromosomes of the foetus in the womb. Often, a girl with Turner Syndrome is not diagnosed until early childhood when growth progressively slows down or, even later, when puberty fails to occur. Any girl who is significantly smaller than other girls of her age should have a chromosome assessment done as the condition is relatively common.

"I was not diagnosed until 11 years. The trouble was, my Mum was small and no-one took much notice. Then my Mum persisted and the specialist diagnosed me on my second visit".

DIAGNOSIS IN THE YOUNG BABY

Baby girls with Turner Syndrome may, when they are born, have puffy hands and feet. This is probably due to the insufficient development of the lymphatic system which drains away body fluids through small vessels under the skin. This puffiness usually disappears soon after birth, although in some girls it can remain or re-occur, occasionally in connection with the use of oestrogen treatment at puberty. There may be pronounced skinfolds at the neck which generally disappear, hut in some cases the neck is broad with more permanent skinfolds. This is referred to as webbing of the neck and cosmetic surgery may be considered. This should be in the first year of life as scarring is less severe than when the girls are older. Small spoon-shaped nails may be noticeable at birth. These can be difficult to cut but parents advise keeping them short and chiropodists can also give helpful advice. Another reason why the diagnosis of Turner Syndrome may be made in the first few months of life is finding a heart defect caused by the narrowing of the main artery leaving the heart (coarctation of the aorta). This usually requires surgery and leads to normal heart function.

INFANCY AND CHILDHOOD

Infancy can be a very difficult time for parents and many will find it easier to cope if the diagnosis has been made early and the problems anticipated and discussed openly with plans for how to deal with them if and when they arise.

Sleeping

There are often difficulties with sleeping patterns. Young girls with Turner Syndrome seem to need very short periods of sleep and are often over active when awake.

Feeding

Problems may arise with some babies because of poor sucking and, later, difficulties with chewing and swallowing. For some babies, poor sucking is due to a high arched palate and a Haberman feeding bottle may be of help. Spoons for feeding need to be small and cups which have a thick rim are helpful because they are easier to grip with the lips. Additional feeding difficulties may arise when introducing solids. A speech therapist can be of great support with feeding problems and can also help with any speech difficulties that may arise as the child gets older. Early feeding problems are very common and, although sometimes quite distressing, they do improve and do not lead to any serious disorders. Knowing this may help parents who can be understandably worried.

Hearing & Vision

The Eustachian tube, which joins the back of the throat and the middle ear allowing drainage from the ears, (it opens or "pops" when you swallow) does not work properly in many girls with Turner Syndrome. Middle-ear infections are common and hearing can be impaired. As the girls progress to Nursery School age, recurrent ear infections may become troublesome and some may require grommets which are small tubes inserted into the eardrum to drain fluid away from the middle-ear. Hearing checks need to be done regularly to make sure any hearing loss is attended to.

Eyes need to be tested for short-sightedness, squints and ptosis (drooping eyelids). A squint or ptosis in one eye will prevent the development of normal vision in the affected eye and this will need specialist care.

Growth

Although girls with Turner Syndrome are born smaller than average they initially grow at a normal rate. However, at around 3 to 4 years of age, the girls may start to appear noticeably smaller than their friends. It is important to treat your daughter appropriately for her age, not her size, giving her encouragement to accept tasks and not trying to overprotect her or prevent her from taking part in challenging activities.

Behaviour

Some parents have noticed that their daughters have shown difficulties in understanding instructions or 'just don't hear" and so hearing checks are always necessary. However, if hearing problems are excluded, try to rephrase instructions and be specific. For instance "don't touch the cooker" may need a fuller explanation such as "don't touch the cooker because you may burn yourself'. Also, point out the hot saucepan and flames or hotplate to support this. Instructions often need to be structured on the basis of how to complete the task required, explaining any outcome that may occur. For example "don't do that" could mean anything when what really needs to be said is "don't do that because...".

Co-ordination

Activities involving dexterity and co-ordination can need special help such as the efforts required in catching a ball, which requires co-ordination of actions of hand and eye. This is particularly shown by difficulty with fine finger movements. Practice and endless patience can improve this as they get older.

We are only too aware of the frustration of parents told many years later that their daughter has Turner Syndrome when they have been saying for years that there was something wrong. Those who look after children should listen to such concerned parents.

Schooling & Development

Intelligence falls across the normal range and there is no increase of mental retardation in girls with Turner Syndrome. Progress at school is generally good and there are many girls who excel, although some do have specific teaming difficulties. Reading age is often advanced whereas writing age is usually delayed and there may be particular difficulties with mathematics and geometry.

There are many girls with Turner Syndrome who achieve university places and go on to further education in preparation for a professional career. Those individuals who do experience difficulties with word comprehension, planning skills, nonverbal tasks, as well as the lack of thought flexibility and social negotiating skills, benefit enormously from help on a one-to-one basis. If you are at all concerned that your daughter is not fulfilling her potential, you should discuss the possibility of having an educational assessment with the head teacher to see where help and support are needed. If it is appropriate, at your request, your specialist will write to the school to explain the problems and provide useful information for a school educational psychologist.

"Some old medical books describe Turner girls as mentally retarded. This is definitely not true. I have been predicted A's and B's for my GCSE'S and I believe I can do as well as any other person".

ADOLESCENCE

The adolescent years can be a difficult time when there are changes to almost all aspects of a young person's life; academic demands increase, social relationships become more complex and independence to some may seem daunting. Apart from maybe being smaller than their friends, other emotional problems may arise. Although many Turner Syndrome girls do overcome any learning difficulties with diligence, their social skills are not always well developed and friendships do not come easily, even in comparison with other short girls. In Denmark, where girls, with Turner Syndrome are encouraged to be particularly open and frank with their peers, they are found to make friends more easily and this is beginning to happen in England too. Girls with Turner Syndrome often find it difficult to be assertive which, as a positive feature, may help them cope better with adversity.

A teenager must be encouraged and supported to develop a sense of achievement and confidence in order to equip them to cope with the larger world outside their family. They are, in general, very caring girls and many have successful careers in nursing.

"I was diagnosed when I was 11 years. When you are that age there are loads of problems on your shoulders with schoolwork, if you were diagnosed earlier it would help".

GROWTH

Short stature is the most common feature in Turner Syndrome and, in childhood, treatment to improve growth and height is an important aim. It should be remembered that parental heights, rather than an individual chromosome abnormality, affect the height of girls with Turner Syndrome and those with tall parents may not require treatment as they could attain a final height of 5' 2" (157 cm). However, a girl with short parents may well, if untreated, reach only 4' 2" (127 cm) and would therefore benefit much more from treatment to improve height. The average final height in women with Turner Syndrome is 4' 8"(142 cm) if they have not been treated. However, we believe this can be increased, possibly by as much as 3"(8 cm), with growth hormone treatment but this will depend on many factors such as the age at which growth hormone treatment was started.

Girls with Turner Syndrome are often small at birth but retain a normal growth rate until the age of about 2 or 3 years when their growth rate begins to slow down. As the years go by they become noticeably short in comparison with their friends. Even with oestrogen therapy, they have only a minimal growth spurt at puberty.

Treatment

Since the mid 1980s there have been treatments developed that may help improve the growth of girls with Turner Syndrome. There are three treatments which are useful in promoting growth; growth hormone, oxandrolone (an anabolic steroid) and oestrogen. The exact doses to use, the sequence and combination of the treatments as well as the age at which to start treatment, have not yet been fully established. Your specialist will

discuss with you your child's individual needs and therefore the best treatment approach to take. Although girls with Turner Syndrome do not have a deficiency of growth hormone, growth hormone is really the most Important treatment for improving final height. In addition, because of an abnormality of the bones which does not respond to normal levels of growth hormone, additional doses (pharmacological doses) of growth hormone seem to be needed to improve both the rate of growth and eventual final height. Although it is appreciated that such treatment does improve final height, probably by as much as 3" (8 cm), it is not yet possible to predict with certainty what final height will be achieved in each individual girl.

Oestrogens and oxandrolone are available as tablets and are taken by mouth whereas growth hormone has to be given by a daily injection, just under the skin (subcutaneously). Details about injections, as well as different injection systems, can be obtained from your specialist as well as from the Child Growth Foundation.

Biosynthetic growth hormone is a relatively new drug and any new drug can carry the risk of unrecognised side effects. However, synthetic versions of growth hormone have now been used for a number of years in girls with Turner Syndrome without any serious side effects arising. There are theoretical risks about increasing the risk of developing diabetes, however, many studies have been carried out and there is still no evidence that growth hormone has any adverse effects. Giving subcutaneous injections can cause a localised skin reaction at the site of the injection but this can usually be treated by varying the injection site.

PUBERTY

The ovaries normally perform two functions; storing eggs and producing the sex hormones - first Oestrogen and, later, progestogen. It is oestrogen that is required to start the process of puberty. In girls with Turner Syndrome, the number of eggs in the ovaries gradually diminishes during childhood, so the ovaries stop functioning properly well before the age that puberty would normally begin and, without replacement oestrogen therapy, puberty will not occur.

At the appropriate age for starting puberty, treatment with oestrogen will initiate breast development and later, with the combination of oestrogen and progestogen, they will start to have regular withdrawal bleeds or "periods". Although girls with Turner Syndrome have non-functioning ovaries, it must be emphasised that they do have a normal uterus and vagina, and will therefore be able to have an entirely normal sex life.

In about 4% of Turner Syndrome girls the ovaries do retain sufficient activity to enable puberty to begin spontaneously, but only 1% will go onto have periods. Even in those women with Turner Syndrome who do start periods spontaneously, the ovaries are likely to stop functioning in early adult life.

Treatment

When there is no ovarian function, puberty will only occur if replacement oestrogen therapy is given. The administration of oestrogen in gradually increasing doses over a period of two to three years will produce all the female sexual characteristics such as breast development, female body shape and the physical and emotional changes appropriate for the teenage years. Later, as the girl matures, the hormone replacement will also be important for sexual drive and function and oestrogen helps to provide sufficient vaginal secretions which make sexual intercourse more comfortable.

It is important to start the process of puberty at the appropriate age, ie. around 11 years, so that a girl with Turner Syndrome is able to start maturing, physically and emotionally, at the same time as her peer group. Towards the end of puberty, another hormone, progestogen, is added to the oestrogen treatment. This is important for maintaining the health of the uterus and in allowing the monthly withdrawal bleeds (periods).

NOTE: A number of girls do have spontaneous development of pubic hair, but this is caused by a hormone secreted from the adrenal glands and is not a sign that the girl is entering puberty.

FERTILITY

Apart from the ovaries, women with Turner Syndrome have normally functioning reproductive organs, ie. the uterus and fallopian tubes, and so they will be able to have sexual relationships with their partners like any other female. However, because of the non-functioning ovaries, infertility is a common problem. There have been successful pregnancies reported using the technique of in-vitro fertilisation with donor eggs. The donor egg is fertilised with the partner's sperm and the resulting embryo is then placed into the uterus of the woman with Turner Syndrome. This method of assisted pregnancy has been performed successfully in women with Turner Syndrome and so with these modern treatment techniques it is potentially possible for a woman with Turner Syndrome to have a child. In very rare cases, the ovaries start and continue to function and pregnancies can occur naturally in women with Turner Syndrome, although this is also rare. The aspects of fertility are covered in more detail in the booklet "The Turner Woman" (Series No. 9).

QUESTIONS AND ANSWERS

1. **Q.** Is my daughter a true girl?

   A. Yes, in every way. The only difference is that her ovaries probably will not function and she will need replacement of the hormones which the ovaries normally make to bring about the physical changes from girl to woman.

2. **Q.** If the X chromosome has a Y fragment, is my daughter partially male?

   A. No, she is definitely female. Identifying a Y fragment is important only because it may increase the potential risk of a cancerous change in the ovaries. The ovaries therefore will have to be removed.

3. **Q.** Will my daughter be able to have normal sexual relations when she grows up?

   A. Yes, exactly the same as for any other woman. The vagina and uterus (womb) are entirely normal in women with Turner Syndrome. Of course, oestrogen replacement therapy will be needed which will also provide lubrication of the vagina enabling sexual intercourse to be more comfortable.

4. **Q.** Will my daughter be able to have children?

   A. This is unlikely without medical help. Through specialised fertility techniques, and by using a donated egg from another woman, it is possible. You will need to discuss this with your daughter's specialist.

5. **Q.** Will medication be needed throughout life?

   A. There will certainly be a need to continue with oestrogen and progestogen treatment. This is both for sexual drive and function and to protect the bones from developing osteoporosis. However, growth hormone and oxandrolone treatments will finish when final height is reached.

6. **Q.** Why is the contraceptive pill used when my daughter is not fertile?

   A. This aspect of treatment often causes the most confusion. A girl with Turner Syndrome needs replacement treatment of oestrogen and progestogen as her ovaries cannot supply these normally. This combination of hormones is the same as that used in contraceptive pills. Although the hormones are the same as those required for replacement therapy, the reason for their use is very different.

7. **Q.** Should medical checks be done throughout oestrogen replacement therapy?

   A. Yes. Your daughter should see the doctor about every six months to have blood pressure and weight checks. Blood pressure should always be measured in the right arm. If she has heart or kidney problems, then these checks may have to be made more frequently and this is something your daughter's specialist will discuss with you.

8. **Q.** Does Turner Syndrome effect intelligence?

   A. No, intelligence is across the normal range. There may be aspects of learning which present more difficulties, particularly abstract thought and reasoning connected with areas such as mathematics, hut this can be made up for by increased skills in other areas.

9. **Q.** Does my daughter have any special educational requirements?

   A. There may be specific learning difficulties which can be quite subtle and difficult to identify but if you feel that your daughter is not fulfilling her potential, you can ask your specialist to write to the school and arrange for an assessment. Extra help on a one-to-one basis, where it is particularly needed, can make an enormous difference to your daughter's progress.

10. **Q.** Are there any other difficulties?

    A. There may be behavioural problems which, in a small but significant group, can be quite severe. These problems are very distressing for the child as well as being difficult for those around them. The need for professional help should be discussed with your specialist.

11. **Q.** Is there a normal life-span for a woman with Turner Syndrome?

    A. Yes.

12. **Q.** What are the main problems for a woman with Turner Syndrome likely to be?

    A. Hopefully, if the diagnosis is made early, short stature will be less of a problem with the early initiation of treatment. As oestrogen is not produced by the non-functioning ovaries, oestrogen replacement will be needed from around the age of 11 years and will be continued throughout adult life. After the normal age of the menopause this will be as hormone replacement therapy (HRT). The main medical problems in adult hood will be the prevention of osteoporosis and the treatment of infertility. Both of these subjects are dealt with in more detail in the second Turner booklet "The Turner Woman".

13. **Q.** When do I tell my daughter about her diagnosis and the full implications of Turner Syndrome?

    A. It is best to be as open as possible and to discuss the condition of Turner Syndrome from the earliest age. Even if you think she is too young to understand the implications, this is often the best time. As she gets older she can ask questions suitable for her age and stage of development. Parents often find it difficult to discuss the subject but it can be started through simple explanations of why she is receiving medication. Any secrecy about the problem can lead to anxiety for the child and the parents.

"Some older girls had not been told until adolescence. They wished they could have been told earlier because it was worse not knowing and wondering what was wrong".

FEATURES OF TURNER SYNDROME

These are the features associated with Turner Syndrome. It Is very Important to remember that it is unlikely for any girl to have all the associated features. Parents with a baby may be concerned that their daughter will attain some more physical characteristics as she gets older. This is not so. as the physical characteristics do not change markedly through life.

Features (in alphabetical order not order of importance or frequency).

- Broad chest with widely spaced nipples
- Chronic middle-ear infections
- Constriction or narrowing of the aorta (coarctation)
- Cubitus Valgus (increased carrying angle of the elbows)
- Diabetes mellitus
- Droopy eyelids (ptosis)
- Dry skin
- Eczema
- Feeding difficulties in early life (usually associated with the high arched palate)
- Folds of skin on the ridge of the eye
- Gastrointestinal problems
- Hearing problems
- Heart murmur
- High blood pressure
- Hypothyroidism (reduced thyroid function)
- Infertility
- Keloid formation (formation of raised scar tissue)
- Kidney and urinary tract problems
- Learning difficulties
- Long-sightedness (hypermetropia)
- Low hairline
- Low-set ears
- Lymphoedaema (build-up of fluid in the limbs)
- Micrognathia (small jaw)
- Narrow high arched palate
- Non-functioning ovaries
- Pigmented naevi (moles)
- Short fingers and toes
- Short-sightedness (myopia)
- Short stature
- Soft spoon-shaped nails which turn up at the tips
- Squint
- Webbed neck

SUMMARY

The diagnosis of Turner Syndrome is often possible at birth (or even before the baby is born) but it is more usually identified in early childhood when growth progressively slows down or, even later, when puberty fails to occur. As soon as the diagnosis is made, it is recommended that every girl with Turner Syndrome should be referred to the care of a growth specialist (Paediatric Endoncrinologist) who is experienced in the overall management of Turner Syndrome. In very rare cases, there can be an additional chromosome abnormality, and it is therefore very important to have an accurate chromosome analysis (karyotype) done to confirm the diagnosis. As adults, with the advice of a specialist, it is important to continue adequate hormone replacement therapy in the form of oestrogens, probably past the normal age for the menopause. This is required for several reasons, including the prevention of osteoporosis and maintenance of a healthy womb. In addition, blood pressure and thyroid function should be regularly monitored.

"I came to the conclusion that people should be made more aware of Turner Syndrome and what it is. I also came to that conclusion because of the trouble all the girls I know had in getting a diagnosis".

SERIES 8

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