Fragile X Syndrome

Fragile X syndrome, called Martin-Bell syndrome, is a genetic disorder and is the most common form of inherited developmental delay. It is a sex-linked genetic abnormality in which a mother is a carrier, transmitting the disorder to her sons. It affects approximately 1 in every 1,000 to 2,000 male individuals, and the female carrier frequency may be substantially higher. Males with this syndrome typically have a moderate to severe form of intellectual delay. Females may also be affected but generally have a mild form of impairment.

Approximately 15% to 20% of those with Fragile X Syndrome exhibit autistic-type behaviors such as:

- poor eye contact
- hand-flapping or odd gesture movements
- hand and nail biting
- Poor sensory skills.

Behavior problems and speech/language delay are common features of Fragile X Syndrome.

People with Fragile X syndrome also have a number of recognizable physical features, including:

- a high arched palate
- strabismus (lazy eye)
- large ears, long face
- large testicles in males
- poor muscle tone
- flat feet
- occasionally mild heart valve abnormalities

Although most people with Fragile X syndrome have a characteristic 'look' (long face and large ears), there are some who do not have typical features.

Many hospitals and laboratories perform blood tests to diagnose Fragile X syndrome. Several treatments are recommended for people with this disorder, including mild medications for behavior problems and therapies for speech and language and sensory improvement. Also, families are advised to seek genetic counseling to understand the inheritable nature of Fragile X Syndrome and to discuss with family members the likelihood other individuals or future offspring may have this disorder.

Hydrocephalus

What is hydrocephalus?

Hydrocephalus is the excessive accumulation of cerebrospinal fluid within the brain. It may be present at birth or may develop later in life. The high fluid pressures on the brain can result in lasting effects. These include impaired vision, headaches, sensitivity to changes in external pressure, hearing sensitivity, hormonal imbalance or seizures.

What causes hydrocephalus?

Hydrocephalus can be caused by a variety of medical problems. It can be present at birth, as a result of a congenital condition. For example, hydrocephalus may occur along with spina bifida, aqueductal obstruction, arachnoid cysts or Dandy-Walker Syndrome. Acquired hydrocephalus may occur at any time during a person's life as a result of intraventricular hemorrhage, meningitis, head injury, tumours, or an unknown cause. Approximately, eighty per cent of individuals with spina bifida also have hydrocephalus.

What are the symptoms of hydrocephalus?

Hydrocephalus can be a serious condition, and must be treated. When it is not treated it can cause permanent brain damage or in severe cases, death. Here are the signs to watch out for:

Infants

- head enlargement
- fontanelle or soft spot on the head is full, tense, or bulging when baby is upright and quiet
- prominent scalp veins
- fever, vomiting, lethargy, irritability
- seizures
- high-pitched cry

Toddlers

- head enlargement
- fever, vomiting, headache, lethargy, irritability
- seizures
- loss of previous abilities

Children & Adults

- fever, vomiting, headache, lethargy, irritability
- seizures
- vision problems
- loss of coordination
- decline in work performance

What are the problems associated with hydrocephalus?

Problems associated with hydrocephalus differ from person to person. A child with congenital hydrocephalus may experience difficulty walking or with eye-hand coordination whereas an elderly person with hydrocephalus may experience incontinence. The problems depend on the underlying cause of the hydrocephalus, extent of brain damage, associated complications, and treatment. Learning disabilities are among the most common complications for people with hydrocephalus. Individuals are able to learn. However, they may require modifications to the way they are taught, especially when it comes to learning new things whether they be academic or on the job skills. Over the years, medical professionals have recognized that some children and adults with hydrocephalus may experience difficulty in one or more of these areas: learning disabilities; memory loss; motor skills; pressure sensitivity; visual impairment; seizures; constipation; incontinence; hormonal imbalance.

Will hydrocephalus cause brain damage?

If untreated, hydrocephalus can cause serious brain damage. Even when treated, it may still cause some injury to the brain. Some cases are more severe than others. The extent of brain damage may also depend on the cause of the hydrocephalus. Someone who has a head injury as a result of a car accident, for example, may have extensive damage to the brain as a result of the injury, not the hydrocep***halus.***

How is hydrocephalus treated?

Treatment for hydrocephalus usually involves surgically implanting a flexible tube (a shunt, see image at left) into the brain ventricles to drain away excess cerebrospinal fluid. With treatment, mental capability and lifespan are similar to those of the general population. However, most people with spina bifida and/or hydrocephalus will have some form of learning disability.

Can hydrocephalus be cured?

There is no cure for hydrocephalus. In most cases, it is a condition that is present for life, except when it is the result of a brain tumour. In this case, it may be possible to remove the tumour, and allow the cerebrospinal fluid to flow.

Learning Disabilities

Children with specific learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or using spoken or written words.

These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling or arithmetic. They include conditions which have been referred to as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, etc.

They do not include learning problems that are primarily due to visual, hearing or motor impairments, developmental delays, emotional disturbance or to environmental disadvantage.

Common categories of Learning Disabilities include:

- Visual Discrimination: noting the difference between b/d, p/q, saw/was
- Visual Memory: remembering what is seen
- Auditory Discrimination: hearing the difference in sound-alike words…but, bat, bit; following a series of instructions
- Spatial Orientation: recognizing the difference between left/right, up/down, next/on top of, ask/tell, early/late, over/under
- Figure/Ground Relationships: seeing letters in words and words in sentences
- Hyperactivity: being difficult to motivate or finding it difficult to complete a task
- Emotional Behaviour: lacking perseverance, over-reacting to common situations, having a poor self-image

Oppositional Defiant Disorder

Oppositional Defiant Disorder is more common in families where at least one parent has a history of mood disorders, oppositional defiant disorder, Conduct Disorder, ADHD, Antisocial Personality Disorder or serious marital discord.

O.D.D. consists of a pattern of negative hostile and defiant behaviour lasting at least 6 months, during which 4 or more of the following are present:

- losses temper often
- argues with adults
- actively defies or refuses to comply with adults requests or rules
- deliberately annoys people
- blames others for his or her mistakes or behaviours
- touchy or easily annoyed by others
- angry and resentful
- spiteful or vindictive

    - This behaviour causes significant impairment in social, academic or occupational functioning

    - Not psychotic

Prader-Willi Syndrome

Prader-Willi Syndrome (PWS) is a genetic condition which is generally caused by a deletion in Chromosome 15. The current incidence of PWS is 1-12,000. It is believed that there is a close connection between PWS and disturbance of the hypothalamus-an area of the brain which controls a number of bodily systems. The following is an overview of characteristics common to Prader-Willi Syndrome. However, not all symptoms are present in all individuals and the intensity of characteristics varies from person to person:

Infants

Characteristics:

- Hypotonia (weak muscle tone)
- Difficulty with feeding because of poor sucking ability
- Delayed motor & language development
- Respiratory difficulties

Helpful Interventions:

Most infants will benefit greatly from early interventions with a physio/occupational therapist who can help set up a program to encourage development and provide assistive devices which will help. A nutritionist can provide information about diet, ensuring that adequate calories are provided. As your baby grows, speech therapy may also enhance your child's skills. Most infants with PWS have a happy disposition and respond well to people. A pediatric endocrinologist can provide information on growth hormone therapy which can assist greatly in muscle development and growth.

CHILDREN & ADULTS

Characteristics:

- Short stature, small hands and feet (without growth hormone treatment)
- Intellectual impairment (average IQ is 70 which is just below normal)
- Learning deficits such as poor short term memory, difficulty with auditory discrimination
- Increased risk of obesity because of a persistent sense of hunger and lack of satiation (hyperphagia), low metabolic rate (60%) and high fat-to-muscle ratio
- Serious health problems if weight is not controlled (diabetes, cardiac & respiratory complications)
- Behavioral problems

Helpful Interventions:

Dietary intervention and exercise are important, especially if food foraging behaviours become evident. Everyone involved in your child's life must be aware of the need to control food intake. It is also important to understand life from the emotional and cognitive perspective of the individual with PWS. Consistency and structure will provide the support required in order for the individual to thrive and grow. With appropriate supports the person with PWS can continue to learn and contribute throughout his/her lifespan.

OTHER CHARACTERISTICS & INTERVENTIONS

- Skin picking
- Excessive sleepiness
- High pain threshold
- Lack of vomit reflex
- Increased risk of scoliosis (curvature of the spine) & osteoporosis (bone thinning)

Recent research indicates that growth hormone treatment can help increase height and muscle mass in children with PWS. Children and adults with PWS should be tested for sleep apnea as well as respiratory problems prior to beginning treatment.

Testosterone is often used in adolescent males to enhance maturity. Testosterone can also promote growth in height and muscle mass.

Children over the age of 10yrs should have a bone scan to test for osteoporosis. There are excellent treatments for this condition which will ensure bone strength and prevent spontaneous fractures from occurring.

Much research continues to take place in the area of genetics and obesity, bringing us closer to understanding and finding helpful medical interventions. As Prader-Willi Syndrome becomes more widely recognized more and more medical research is taking place around the world

Rett Syndrome

Rett Syndrome (RS) is a unique developmental disorder which begins to show its affects in infancy or early childhood. It is seen almost exclusively in girls, although it can occur rarely in boys. It is found in a variety of racial and ethnic groups throughout the world.

What causes Rett syndrome?

Rett syndrome is caused by a mutation on the MECP2 gene of the X chromosome. The MECP2 gene is responsible for turning off other genes when they are no longer needed in development. (Most genes are active for only a specific period in development and then shut off forever.) The MECP2 mutation (change in the gene) causes the turn-off mechanism to fail, allowing other genes to stay active when they are no longer needed, and allowing proteins and enzymes to build up and become toxic to the central nervous system. So, RS is a genetic disorder of developmental arrest or failure of brain maturation. This is thought to occur when subsets of neurons and their connections (synapses) are disrupted during a very dynamic phase of brain development. This deviation occurs in the first few months of life, when synapses are normally being overproduced, only to be pruned later on to the normal adult number. In RS, these synapses appear to be under produced, or possibly over pruned.

She seemed to develop so normally. What happened?

RS results from a chain of events beginning with the MECP2 genetic mutation. Mutations occur naturally in everyone all the time and most do not cause problems. The MECP2 mutation results in a shortage or absence of MeCP2 protein needed to direct other genes. These downstream genes produce proteins or factors which control the normal development of selected regions of the brain responsible for sensory, emotional, motor and autonomic function. Development appears to be normal in early infancy until the factors are needed to be active or inactive, for further brain development. Without these factors, selected regions of the brain remain developmentally immature. This explains why the child appears to be developing normally in the first months of life.

If it is a genetic, does this mean I may have another child with RS?

The chance of having more than one child with RS is very small, less than one percent. This means that more than 99% of the time, the mutation is sporadic, just occurs on its own and is not repeated in a family

At what age does Rett syndrome begin?

The age when RS begins and the severity of different symptoms may vary. The child with RS is usually born healthy and shows an early period of apparently normal or near normal development until 6-18 months of life, when there is a slowing down or stagnation of skills. A period of regression then follows when she loses communication skills and purposeful use of her hands. Soon, stereotyped hand movements, gait disturbances, and slowing of the normal rate of head growth become apparent. Other problems may include seizures and disorganized breathing patterns which occur when she is awake.

There may be a period of isolation or withdrawal when she is irritable and cries inconsolably. Over time, motor problems may increase, while other symptoms may decrease or improve.

Since she loses skills, is RS degenerative?

Rett syndrome is not a degenerative disorder, but it is a developmental disorder. Barring illness or complications, survival into adulthood is expected.

Apraxia Information

What kind of disabilities will she have?

Apraxia (dyspraxia), the inability to program the body to perform motor movements, is the most fundamental and severely disabling aspect of RS. It can interfere with every body movement, including eye gaze and speech, making it difficult for the girl with RS to do
what she wants to do. Due to this apraxia and her inability to speak, it is very difficult to make an accurate assessment of her intelligence. Most traditional testing methods require her to use her hands and/or speech, which may be impossible for the girl with RS. Her mobility may be delayed and she may have difficulty crawling or walking.

General Genetic Information

How often does RS occur?

RS is most often misdiagnosed as autism, cerebral palsy or non-specific developmental delay.
While many health professionals may not be familiar with RS, it is a relatively frequent cause of delayed development in girls. The prevalence rate in various countries is from 1:10,000 to 1:23,000 live female births, making it three times more common in females than phenylketonuria (PKU), a congenital error of metabolism for which every newborn in the USA is tested.

How is Rett syndrome diagnosed?

The diagnosis of RS is made on the basis of the presence of the MECP2 mutation (a blood test) and fulfillment of the diagnostic criteria. Most mutations are sporadic, and occur only once in a family. There are more than 100 mutations in the MECP2 gene which cause RS. Most of these are found in eight hotspots in the coding region of the gene (part of the gene which makes the MeCP2 protein). Mutations have been found in more than 80% of girls who fulfill the diagnostic criteria for RS. For the remaining 20% who do not currently show a MECP2 mutation, yet do still fulfill the diagnostic criteria, it is felt that their mutations are located in a part of the very large MECP2 gene not yet screened. So, at this time, it is possible to have RS with or without the MECP2 mutation. Because researchers now understand that the MECP2 mutation also causes other disorders, it is possible to have the MECP2 gene mutation and not have RS

What disorders must be ruled out?

Other possible conditions which could look like RS must be ruled out. They include Angelman syndrome (Happy Puppet Syndrome) and Prader-Willi syndrome, metabolic disorders such as OCT deficiency, disorders of organic acids and amino acids; storage diseases, mitochondrial disorders, and Batten Disease. While there are no scientific tests for them, autism and cerebral palsy are often misdiagnosed.

How do RS differ from autism?

The MECP2 gene mutation is found in RS and has also been revealed in some cases of autism, so they are branches of the same tree. While RS occurs primarily in girls, autism occurs much more frequently in boys. In both conditions, there is loss of speech and emotional contact. However, symptoms seen in RS and not in autism include deceleration of the rate of head growth and loss of purposeful hand skills and mobility. While hand flapping is seen frequently in autism as visual stimulation, the wider range of compulsive purposeless hand stereotypes common to RS are not seen in autism. The girl with RS almost always prefers people to objects, but the opposite is seen in autism. Unlike those with autism, the RS girl often enjoys affection. While girls with RS often have autistic tendencies at an early age, these features decrease over time.

What are the diagnostic criteria for Rett syndrome?

Most parents know their daughters better than anyone. Often, they know that Rett syndrome fits from the first description. Physicians use Diagnostic Criteria Guidelines

What are the stages of Rett syndrome?

Stage I Early Onset Stage Age: 6 months to 1.5 years Duration: Months
Stage II Rapid Destructive Stage Age: 1 to 4 years Duration: Weeks to Months
Stage III Plateau Stage Age: Preschool to school years Duration: Years
Stage IV Late Motor Deterioration Stage Age: When stage III ceases, 5-25+ years Duration: Up to decades

Do all girls move through the stages of Rett syndrome similarly?

No. The stages of Rett syndrome are simply provided to help understand the natural history of the disorder. The course of RS is predetermined according to her mutation and X-inactivation status, and varies from one child to another, including the age when RS begins and the speed and severity of symptoms. Therefore, two girls of the same age can appear quite different.**Can the severity be predicted?**

Just as in any other disorder, there can be a wide range of disability ranging from mild to severe. It is difficult to predict the intensity of symptoms in any individual child. Many girls begin walking within the normal range, while others show significant delay or inability to walk independently. Some begin walking and lose this skill, while others continue to walk throughout life. Still others do not walk until late childhood or adolescence. The same range holds true for using her hands and other skills she may acquire

What will she be able to do?

Although the girl with RS will need help for most activities of daily living, she can learn some independent skills. Most girls can learn to use the toilet and many can learn to feed themselves by hand or with utensils with some assistance. Some girls can learn to use augmentative devices to communicate. Despite their difficulties, girls and women with RS can continue to learn and enjoy family and friends well into middle age and beyond. They experience a full range of emotions and show their engaging personalities as they take part in social, educational and recreational activities at home and in the community

What is life expectancy?

Due to the rarity of RS, very little is known about long term prognosis and life expectancy. Most of those who have been identified are under 18 years of age. It is often difficult to identify older girls and women due to the frequent lack of complete infant and childhood developmental records. However, studies have determined that a girl with RS has a 95% chance of surviving to age 20-25 years. This compares to a 98% survival probability for the general U.S. female population. Between the ages of 25-40, the survival rate drops to 69% in RS, compared to 97% in the general U.S. female population. The average life expectancy of a girl given the diagnosis of RS may exceed 47 years. While there are a few women in their 40"s and 50"s who have RS, there have been too few women studied to make reliable estimates beyond age 40. While these statistics show that life expectancy is less in RS, it is not nearly as low as other similar neurological disorders

What are the causes of death?

It is important to note that only 7% of cases reported to the IRSA have resulted in death. This means that 93% of those diagnosed are still living. The most frequently reported causes of death (one-quarter of deaths) are variations of sudden, unexplained death with no apparent underlying cause such as an acute injury or infection. The factors most strongly associated with an increased risk of sudden unexplained death in RS are uncontrolled seizures, swallowing difficulties and lack of mobility. Neither physical or occupational therapy, nutritional status or living arrangements made a difference in the incidence of sudden unexplained death. Ongoing studies will help predict which girls are at greatest risk and which girls might benefit most from new medical or educational interventions. Other deaths have resulted from pneumonia. The factors most strongly associated with an increased risk of death by pneumonia are compromised lung function due to scoliosis and difficulty swallowing. Other causes of death include malnutrition, intestinal perforation or twisted bowel, as well as accidents and illness.

What has research taught us about RS?

Studies have revealed that although the brain is 30% smaller than normal, there are no obvious malformations, gross abnormalities or signs of infection. There is increased neuronal cell packing density. That is, cells should be further apart, but in RS they are very close together because cell-to-cell connections are not well-developed along the route. Neurons are reduced in size and there is reduced branching, which interferes with functions such as thinking, doing, and feeling. The number of synapses (brain-cell to brain-cell connections) is about half the normal number. Abnormalities in multiple areas of the brain may account for the following clinical symptoms:

Frontal lobe: Cerebral blood flow appears reduced, particularly in frontal brain regions. This looks like what might be seen in a 7 week-old child. This area is much more involved than other brain parts. It is necessary for mood and emotion
Caudate: much smaller than normal; involved in cognition, awareness and behaviour
Putamen: no anatomical change; necessary for movement
Temporal lobe (limbic system): no anatomical change; needed for memory, learning, emotion, behavior.
Cerebellum: reduction in some cell populations; needed for equilibrium and balance.
Hippocampus: no anatomical change; necessary for information processing.
Substantia Nigra: marked reduction in the pigment, melanin, and degeneration of cells; necessary for movement and critical thinking
Medulla (Brain stem): strong evidence of brain stem immaturity, leading to problems with the autonomic nervous system, such as sleep, salivation, breathing, heart rate, swallowing, bowel motility, blood circulation in hands and feet, and reduced sensitivity to pain.
Neurotransmitters: reduced. These include:
Dopamine - necessary for movement and critical thinking
Acetylcholine - necessary for memory, cognition, movement control
Glutamate - necessary for brain plasticity, important in seizures and cell death

What happens when she hyperventilates?

Deep breathing expels more carbon dioxide from the body than usual, so her hyperventilation causes her carbon dioxide level to fall. Carbon dioxide is one of the body's normal waste products carried in the blood. Its purpose is to maintain the acid/alkali balance so that cells can function normally. When her carbon dioxide level falls, cells cannot function normally. Hyperventilation may cause her to feel dizzy and her fingers to tingle.

Are the abnormal breathing episodes or tremors related to seizures?

The abnormal breathing episodes can resemble epileptic seizures, but they are not. Sometimes, what is thought to be a seizure is not, and some seizures may fail to be recognized when she is asleep or even awake. Vacant spells are brief interruptions of awareness that may resemble seizures but are not.

Will she always breathe this way?

For the majority of girls, irregular breathing patterns become less noticeable as they get older. The younger girl with RS appears to have more hyperventilation while the older girl has more of a type of breathing known as Valsalva's maneuver.

What should we do about her irregular breathing?

Although episodes of breath holding produce great anxiety for parents to watch, they are always followed by regular breathing. Observing the irregular breathing can cause great concern, but experts in RS recommend a low key approach, taking comfort in the fact that girls do become accustomed to the irregular breathing and regular breathing will soon return. While it may seem like forever, it is important to stay calm and in control. There is a lot of research at present directed at answering these questions.

How can breathing be so abnormal when she is awake and normal when she sleeps?

In Rett syndrome, irregular breathing occurs only when she is awake and does not usually occur during sleep. When she is awake, the periods of abnormal breathing result from probable immaturity of neurons regulating breathing mechanisms. During periods of sleep, the changes in body function allow us to breathe regularly and continuously. When abnormal breathing is seen in some girls with RS during sleep, it is of the obstructive type, usually from enlarged tonsils. Airway obstruction may be caused by mechanical problems in the breathing passages. Mouth breathing, snoring and frequent ear infections may be signals that your daughter has a problem which should be evaluated by an ear, nose, and throat specialist.

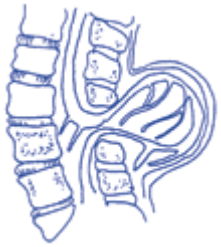
Spina Bifida

Spina = spine Bifida = split

What is spina bifida?

In Canada, about 4 out of every 10,000 children are born with spina bifida. Spina bifida is a neural tube birth defect (NTD) which occurs within the first four weeks of pregnancy. The spinal column fails to develop properly resulting in varying degrees of permanent damage to the spinal cord and nervous system.

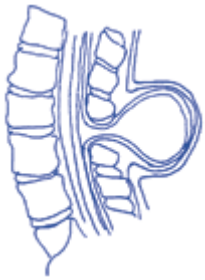
Infants born with spina bifida may have an open lesion on their spine where significant damage to the nerves and spinal cord occurs. Although the spinal opening is surgically repaired shortly after birth, the nerve damage is permanent. This results in varying degrees of paralysis of the lower limbs, depending largely on the location and severity of the lesion. Even with no visible lesion, there may be improperly formed or missing vertebrae, and accompanying nerve damage.



The three most common types of spina bifida are:

Myelomeningocele **(my'-low-meh-nin'-go-seal)**

Myelomeningocele is the most severe form in which the spinal cord and its protective covering, the meninges, protrude from the opening in the spine.



Meningocele **(meh-nin'-go-seal)**

Meningocele spinal cords develop normally, but only the meninges protrudes from the opening created by damaged or missing vertebrae and may be exposed.

Occulta **(oh-kul'-tah)**

Occulta, which means "hidden", indicates that the defect, where one or more vertebrae are malformed, is covered by a layer of skin. Occulta is the mildest form.

What causes spina bifida?

There is no single known cause of spina bifida. Researchers are studying the effects of heredity, nutrition, environment and pollution, which lead to physical damage to the fetus.

How is spina bifida treated?

Treatment involves surgery and therapy to minimize further neurological damage and address the resulting conditions. Treatment for the variety of effects of spina bifida and hydrocephalus can also include medication, physiotherapy and the use of assistive devices.

Many people with spina bifida will need mobility supports such as braces, crutches, or wheelchairs. Almost all will have some form of bladder or bowel dysfunction, conditions which they must learn to control and manage.

Can spina bifida be cured?

There is no cure. Ongoing therapy, medical care and/or surgical treatments will be necessary to help prevent and manage complications throughout an individual's life.

Just forty years ago, only 10% of babies born with spina bifida survived their first year. Today, with research and advances in medical technology, 90% survive and thrive!

*Spina Bifida & Hydrocephalus Association of Ontario

Tourette Syndrome

Disorder

Tourette Syndrome (TS) is a neurological or "neurochemical" disorder characterized by tics -- involuntary, rapid, sudden movements or vocalizations that occur repeatedly in the same way.

The cause has not been established, although current research presents considerable evidence that the disorder stems from the abnormal metabolism of at least one brain chemical (neurotransmitter) called dopamine. Very likely other neurotransmitters, such as serotonin, are also involved.

In 1825 the first case of TS was reported in medical literature by Dr. Itard. It was a description of the Marquise de Dampierre, a noblewoman whose symptoms included involuntary tics of many parts of her body and various vocalizations including echolalia [repetition or echoing of verbal utterances] and coprolalia [involuntary swearing or the involuntary utterance of obscene words or socially inappropriate & derogatory remarks]. She lived to the age of 86 and was again described in 1883 by Dr. Georges Gilles de la Tourette, the French neurologist for whom the disorder was named. Samuel Johnson, the lexicographer and André Malraux, the French author, are among the famous people who are thought to have had TS.

Symptoms

The most common first symptom is a facial tic, such as rapidly blinking eyes or twitches of the mouth. However, involuntary sounds, such as throat clearing and sniffing, or tics of the limbs may be the initial signs. For some, the disorder begins abruptly with multiple symptoms of movements and sounds.

The symptoms include;

1. Both multiple motor and one or more vocal tics present at some time during the illness although not necessarily in the same way;
2. The occurrence of ticks many times a day (usually in bouts) nearly every day or intermittently throughout a span of more than one year;
3. The periodic change in the number, frequency, type and location of the tics, disappear for weeks or months at a time; and
4. Onset before the age of 18.

The term "involuntary" used to describe TS tics is a source of confusion since it is known that most people with TS do have some control over the symptoms. What is recognized is that the control which can be exerted from seconds to hours at a time, may merely postpone more severe outbursts of symptoms. Tics are experienced as irresistible as the urge to sneeze and must eventually be expressed. People with TS often seek a secluded spot to release their symptoms after delaying them in school or at work. Typically, tics increase as a result of tension or stress (but are not caused by stress) and decrease with relaxation or concentration on an absorbing task.

Frequency/Ratio of TS

Since many people with TS have yet to be diagnosed, there are no absolute figures. Recent genetic studies suggest that the figure may be one in one hundred when those with chronic and transient tics are included in the count.

Tic Categories

Two categories of TS tics and some common examples are:

Simple:

Motor - Eye blinking, head jerking, shoulder shrugging and facial grimacing;

Vocal - Throat clearing, yelping and other noises, sniffing and tongue clicking.

Complex:

Motor - Jumping, touching other people or things, smelling, twirling about and, although very rare, self-injurious actions including hitting or biting oneself;

Vocal - Uttering ordinary words or phrases out of context, echolalia (repeating a sound, word or phrase just heard) and in rare cases, coprolalia (vocalizing socially unacceptable words). The range of tics or tic-like symptoms that can be seen in TS is enormous. The complexity of some symptoms often confuses family members, friends, teachers and employers who may find it hard to believe that the actions or vocal utterances are "involuntary".

Diagnoses

A diagnosis is made by observing symptoms and by evaluating the history of their onset. No blood analysis, x-ray or other type of medical test exists to identify TS. However, a doctor may wish to order an EEG [Electroencephalogram], CAT [Computerized Axial Tomography] scan or certain blood tests to rule out other ailments that could rarely be confused with TS.

Cure/Remission of TS

At this point in time, there is no cure for TS. Remission can occur at any time. Present data suggests that the tic symptoms tend to stabilize and become less severe in adult life. Those diagnosed with TS can anticipate a normal life span

Associated Behaviours

The frequency of co-occurrence is still controversial, but some people with TS may have additional problems such as:

- Obsessions - which consist of repetitive, unwanted or bothersome intrusive thoughts?
- Compulsive behaviours - repetitive, often ritualistic actions in which the person feels that something must be done over and over, often in a very specific manner. Examples include touching an object with one hand after touching it with the other hand to "even things up", or repeatedly checking to see that the flame on the stove is turned off. Children sometimes beg their parents to repeat a sentence many times until it "sounds right".

Attention Deficit Disorder (ADD or ADHD) (with or without hyperactivity) - children may show signs of hyperactivity before TS symptoms appear. Indications of ADHD may include:

- difficulty in concentrating
- failing to finish what is started
- not seeming to listen
- being easily distracted
- often acting before thinking
- easily overwhelmed and frustrated
- shifting constantly from one activity to another
- needing a great deal of supervision
- general fidgeting.

Adults may exhibit signs of ADHD such as:

- overly impulsive behaviour
- concentration difficulties
- need to move constantly.

ADD without hyperactivity includes all of the above symptoms except for the high level of activity.

Learning Disabilities - such as dyslexia, reading, writing and perceptual difficulties, problems with visual/motor integration.

Behavioural problems - which may result from obsessive compulsive traits, attention problems, poor self-esteem due to TS symptoms, and poor school performance.

Sleep disorders - which may include walking or talking in one's sleep, delayed sleep onset and frequent awakenings.

Difficulties with impulse control - in which routine interactions may rapidly escalate into major confrontations resulting in inappropriate behaviours, ranging from mild unruliness to explosive, defiant rage and aggression altogether out of proportion to the underlying incident.

Early Treatment

Is it important to treat TS early? Yes, if the symptoms are disruptive or frightening. The symptoms portrayed may provoke ridicule and rejection by peers, neighbours, teachers and even casual observers. Parents may be overwhelmed by the strangeness of their child's behaviour. The child may be threatened, excluded from family activities and prevented from enjoying normal interpersonal relationships. These difficulties may become greater during adolescence, an especially trying period for young people and even more so for a person coping with a neurological problem. Early diagnosis and treatment is advisable to avoid psychological harm.

Treatment of TS

The majority of people with TS are not significantly disabled by their tics or behavioural symptoms and therefore do not require medication. However, there are medications to help control symptoms when they interfere with functioning. The drugs include haloperidol (Haldol®), pimozide (Orap®), clonidine (Catapres®), clonazepam (Rivotril®) and nitrazepam (Mogadon®). Stimulants such as methylphenidate (Ritalin®) and dextroamphetamine (Dexedrine®), that are prescribed for hyperactivity may temporarily increase tics and should be used cautiously. Obsessive compulsive symptoms may be controlled with fluoxetine (Prozax®), clomipramine (Anafranil®) and other similar medications.

The dosage necessary to achieve maximum control of symptoms varies for each patient and must be gauged carefully by a doctor. The medicine is administered in small doses with gradual increases to the point where there is a maximum alleviation of symptoms with minimal side effects. Some of the undesirable reactions to medications are fatigue, motor restlessness, weight gain and social withdrawal, most of which can be reduced with specific medications. Side effects such as depression and cognitive impairment can sometimes be alleviated with dosage reduction or a change of medication.

Other types of therapy may also be helpful. Sometimes psychotherapy can assist a person with TS and help his/her family cope with the psycho-social problems associated with TS. Some behavioural therapies can teach the substitution of one tic with another that is more acceptable. The use of relaxation techniques and/or biofeedback may help during prolonged periods of high stress.

Genetics

Genetic studies indicate tic disorders, including TS, are inherited as a dominant gene(s) that may produce varying symptoms in different family members. A person with TS has about a 50% chance of passing the gene(s) to one of his/her children. However, the gene(s) may express as TS, as a milder tic disorder, or as obsessive compulsive symptoms with no tics at all. It is known that a higher than usual incidence of milder tic disorders and obsessive compulsive behaviours are more common in the families of TS patients.

The sex of the child also influences the expression of the gene(s). The chance that the child of a person with TS will have the disorder is at least three times higher for a son than for a daughter. Yet only a minority of the children who inherit the gene(s) will have symptoms severe enough to ever require medical attention. In some cases, TS may not be inherited; these cases are identified as "sporadic" TS because a genetic link cannot be found.

**Tourette Syndrome Foundation of Canada*

Williams Syndrome

Williams syndrome is a rare genetic disorder. Like Down syndrome it is caused by an abnormality in chromosomes, and shows a wide variation in ability from person to person. Individuals diagnosed with Williams syndrome have a unique pattern of emotional, physical and mental strength's and weaknesses. For parents, teachers, and support people, learning about this pattern can be a key to understanding an individual with Williams and in helping them achieve their full potential.

It is a non-hereditary syndrome which occurs at random and can affect brain development in varying degrees, combined with some physical effects or physical problems. These range from lack of co-ordination, slight muscle weakness, and possible heart defects and occasional kidney damage. Hypercalcemia, a high calcium level, is often discovered in infancy, and normal development is generally delayed.

The incidence is approximately 1 in 20,000. As the medical professional and the public is alerted more and more cases are being diagnosed yearly.

Diagnosis

Diagnosis is not easy as effects vary considerably, but the different clues can be added up to produce a near-certainty. The cause of Williams syndrome is a micro deletion of part of chromosome 7 which includes the Elastin Gene. A blood test (called the FISH technique) can establish if the Elastin Gene is in fact missing.

Physical Clues

Facial features:

All the children have a facial similarity, referred to as "elfin" features. They include a wide mouth with large, slack bottom lip; very retrousse nose with flattened bridge; slightly "bulgy" cheeks; irregular teeth widely spaced; sometimes a squint.

Early problems:

These can include low birth weight, often after being "late for dates", slow weight gain. Sometimes weight loss; below average growth; very slow feeding, restless sleeping, and irritability; sometimes a hernia, a squint and excessive vomiting leading to dehydration and constipation. A raised calcium level is found in some babies.

Heart problems:

All Williams syndrome individuals appear to have a slight narrowing of the aorta above the valve, in many cases insignificant, but occasionally leading to more serious heart defects.

Psychological Clues

Hyperactivity in early years:

- extreme uninhibited behaviour
- excessive talking, in an inappropriate and "adult" manner
- over-friendliness with strangers
- compulsion to talk to adults, while being unable to make friends with peers
- high verbal ability leading to artificial expectations of matching mental ability
- obsessive interest in certain things: e.g. cars, ambulances, vacuums, wheels etc.
- fear of heights, open stairs, uneven surfaces
- very short concentration span adding to learning difficulties, high distractibility
- emotional immaturity exhibited by over-reaction to events and exaggerated displays of fear, excitement, sadness, happiness etc.

Hypersensitivity to noise:

This is the clue most common to all Williams syndrome children. About 90% show great distress on hearing sudden loud noises, such as guns firing, balloons bursting, Christmas crackers, fireworks etc.

Treatment

Early diagnosis means better understanding of the problems which may arise, leading to a happier life for the child and relief and support for the parents. There is no "cure" for Williams syndrome as it is caused by a genetic/chromosomal defect. When hypocalcaemia (high blood calcium levels) occurs in the first year or two of life, a low calcium diet is prescribed.

Individuals with Williams syndrome can develop health problems related to the syndrome and also ordinary health problems unrelated to the syndrome. It is important to make good use of local resources (e.g. general practitioners, health visitors, local education departments etc.) in addition to using specialists and experts in Williams syndrome. Continuing further education can help to realize full potential.