HUNTER SYNDROME
A RARE GENETIC DISEASE

An information booklet for the general public

Takeda

INTRODUCTION TO HUNTER SYNDROME A RARE GENETIC DISEASE

Whether your son or someone you know has recently been diagnosed with Hunter syndrome, or is living with the condition, **this resource has been developed to provide you with information and support with stories from families living with Hunter syndrome.**

For more information, visit **huntersyndrome.in/public**

Reference: Takeda Pharmaceutical Company Limited. Welcome to Huntersyndrome.info [Internet]. [updated April 2020; cited 2022 March 20]. Available from: https://huntersyndrome.info.

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ABOUT HUNTER SYNDROME

What is Hunter syndrome?

Hunter syndrome, also known as mucopolysaccharidosis type II (MPS II), is a rare genetic disease almost exclusively affecting boys. It is estimated that the condition is present in 1 in every 162,000 new-born babies.

Hunter syndrome can affect any part of the body and has a number of signs and symptoms. In the majority of children these begin to show between the ages of 2 and 4 years.

What causes Hunter syndrome?

Hunter syndrome is a genetic disease caused by the deficiency or absence of an enzyme called iduronate-2-sulfatase (I2S).

In Hunter syndrome, the gene that codes for I2S contains a mutation (a change), which means that the enzyme is produced with errors that stop it working properly, or the enzyme is not produced at all.

I2S is essential for breaking down particular molecules, known as glycosaminoglycans (GAGs). If I2S is deficient or absent, as in Hunter syndrome, GAGs build up, which prevents cells from functioning properly.

Talk to your doctor

If you think that your child or someone you know is showing symptoms of Hunter syndrome, speak to your doctor.

SIGNS AND SYMPTOMS

What are the signs and symptoms of Hunter syndrome?

Hunter syndrome can affect any part of the body and has a variety of signs and symptoms.

It is important to remember that many of these signs and symptoms are common in children, but it is the combination of them that may indicate Hunter syndrome. There is no typical patient experience.

There are **two types of Hunter syndrome**: **neuronopathic** (with cognitive impairment) and **non-neuronopathic** (without cognitive impairment).

Both types have signs and symptoms that affect the body, but the neuronopathic type also has symptoms that affect the brain and nervous system, meaning that behaviour and development are also affected. Nearly 7 out of 10 people with Hunter syndrome have the neuronopathic type of the disease.

For more information about the signs and symptoms of Hunter syndrome, visit huntersyndrome.in/public

Neuronopathic symptoms

DEVELOPMENTAL

- Delays in childhood development (e.g. delayed walking, delayed speech)
- Learning difficulties

NEUROLOGICAL

- Cognitive decline
- Seizures (may be 'absence' seizures, i.e. staring)

BEHAVIOURAL

- For example, hyperactivity, obstinacy, aggression

MOTOR FUNCTION

- Motor function problems

Non-neuronopathic symptoms

HEAD

- Particular facial features, such as a prominent brow, broad nose and thick lips
- Large head
- Large tongue

BREATHING

- Frequent coughs and colds
- Breathing problems, including noisy breathing and snoring

BONES AND JOINTS

- Joint stiffness
- Curled-in fingers
- Carpal tunnel syndrome

ABDOMEN

- Enlarged stomach
- Hernias (umbilical or inguinal)

EARS AND NOSE

- Frequent ear infections
- Hearing loss
- Long-term runny nose

Silas, 1.5

Silas, 5

Hunter syndrome is a progressive disease

Children with Hunter syndrome often appear healthy at birth. As the GAGs build up over time, the signs and symptoms of Hunter syndrome will progress.

In neuronopathic Hunter syndrome, as well as the symptoms affecting the body progressing, symptoms affecting the brain and nervous system will also advance, meaning that there will be a decline in speech, learning and cognitive abilities.

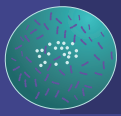
Unfortunately, many symptoms of Hunter syndrome cannot be reversed once they have progressed to a certain point. However, it is important to remember that every child with Hunter syndrome is different, and there is no single disease course.

Lysosomal enzyme is deficient or absent

GAGs are produced by the body

GAGs are accumulated in the lysosome

Insufficient enzyme activity



GAGs accumulate in lysosome causing progressive damage to cells, tissues and organs

For more information, visit huntersyndrome.in/public
If you suspect your son has Hunter syndrome, speak to your doctor.

AIDEN AND AJ

Aiden was born a beautiful, healthy baby boy but he had frequent ear infections that we were told were typical. He had two sets of tubes put in his ears and then adenoids removed when he was a year and a half. He got colds a lot.

When he was about 2 years old, I noticed Aiden had speech delay. So, I got him into early intervention and his paediatrician suggested that it was just something that kids go through, that he would catch up. He had occupational therapy, physiotherapy and speech therapy for a year. Then his paediatrician suggested we see a geneticist because of Aiden's facial features; he wanted to have him checked further.

With AJ, I didn't notice any symptoms at all. But when Aiden was diagnosed and the geneticist pointed out some things about AJ, then I noticed it. AJ was 18 months old and not walking yet. AJ had speech delay, just like his brother. He also had the joint contractures: his arms were not as stiff and bent as Aiden's but still wouldn't go straight. AJ also had ear infections as a baby, so he had tubes put in and his adenoids removed.

Toni Ann, mother of Aiden and AJ

> "With AJ, I didn't notice any symptoms at all. But when Aiden was diagnosed and the geneticist pointed out some things about AJ, then I noticed it."
>
> Toni Ann, mother of Aiden and AJ

DIAGNOSIS

How is Hunter syndrome diagnosed?

There are a number of diagnostic tests that may be performed to determine or rule out a diagnosis of Hunter syndrome.

Urinary GAG testing

Testing for urinary GAGs is often the first test performed if Hunter syndrome is suspected.

Iduronate-2-sulfatase (I2S) enzyme activity

The activity of the enzyme I2S can be tested using a blood sample.

Prenatal diagnosis

Hunter syndrome can be diagnosed before birth by measuring the activity of the I2S enzyme in the placental tissue or amniotic fluid.

Genetic testing

Testing the gene that is mutated in Hunter syndrome (*IDS*) can identify people as carriers.

SILAS

When Silas was 1 year old, he got a really bad cold with a high temperature and obstructive bronchitis, which took us to hospital. A doctor casually asked us if Silas' head circumference had been checked because he thought it was too big. A few months before his second birthday, our little boy was given an MRI scan. The head physician told us that the MRI showed an abnormality that might be a symptom of a rare disease called mucopolysaccharidosis. We had to wait another month for the blood test results to clearly tell us that Silas had Hunter syndrome.

Natalie, mother of Silas

HUNTER AND KINGSTON

Hunter is my oldest – he's 7 years old. He's a livewire. From the very beginning he was sick all the time. We were in the hospital or the doctor's office every month with high fevers because of ear infections. He had an umbilical hernia that never went away.

When Kingston was born he was in intensive care for 3 weeks. He started off with lung problems and after that it was like he was always on breathing treatments. He always had a runny nose and also had ear infections. We found a really good doctor and she wanted to test for developmental delays. She sent us to a geneticist but we didn't really know what was wrong until we got the phone call stating that the boys had MPS II. Hunter was 2 years old and Kingston was 14 months when they were diagnosed.

Brittany, mother of Hunter and Kingston

LIVING WITH HUNTER SYNDROME

Caring for a child with Hunter syndrome can affect every area of daily life, not just in terms of medical needs. Hunter syndrome will impact the lives of the family and friends of someone with the disease practically, socially and emotionally. There are several forms of support available:
see the Resources chapter for more information.

Non-neuronopathic symptoms?

Symptoms such as problems with mobility and fine motor skills are likely to require adjustments to the home environment so that your child can move around the house more easily, play safely and manage more tasks by themselves. Adaptations may help you with mealtimes, bedtime, safety around the house and outdoors, and so on.

Neuronopathic symptoms?

Children with neuronopathic Hunter syndrome often have challenging behaviour such as tantrums, obstinacy and hyperactivity. This means they need close supervision at all times, and a specially safeguarded environment to prevent injuries and accidents. As the disease develops, children will become progressively more dependent on carers for day-to-day needs.

Healthcare

A team of healthcare professionals with a variety of specialisms may be involved in your child's care. This is sometimes referred to as a multidisciplinary team (MDT).

Employment

If you are a family member or caregiver for a child with Hunter syndrome, your work life may also be affected. You may need to take time off work, or to work flexibly, to attend healthcare appointments, or to care for your child.

Education

Children with Hunter syndrome may have special educational needs, and physical limitations, which will mean adaptations will need to be made to the learning environment. Some children with Hunter syndrome will be able to attend mainstream school, whereas others will benefit more from being in a school for children with special educational needs.

AIDEN AND AJ

A week doesn't go by where we don't have a doctor's appointment, or specialist appointment, or a follow-up, or a school meeting, but Aiden and AJ do it all with a smile; their strength gives me strength.

Aiden chews a lot. He has a pacifier that he likes to chew on. Their toys are all rubber so they can't hurt their teeth. If they are excited, at a playground for instance, AJ will run up to the other kid and want to play but he'll push them. He's not doing it maliciously, he just doesn't understand that you have to be gentle. We remind him all the time. They require a lot of attention and work. I always have to keep my eyes on them because they get into things, they get outside, they wander out of my front door.

Toni Ann, mother of Aiden and AJ

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HUNTER AND KINGSTON

You really don't know what to expect with this disease because it changes every child differently. We didn't see a lot of speech until about 4 years old for Hunter. The boys had speech therapy and therapy for their physical ailments and sensory issues. Hunter and Kingston go to a special needs school.

My advice to other parents is to find someone you can meet face-to-face who also has children with MPS II. To see these other little kids and to see all of these boys full of so much love – it just gives you reassurance.

Brittany, mother of Hunter and Kingston

AIDEN AND AJ

We like to do anything that makes the boys happy. Whatever they want to do, we all do as a family. We like to go out to dinner together too: believe it or not, they're really good as long as they have their iPads to keep them busy. We like to be outside, we are very outdoorsy people, and the boys like it too.

Toni Ann, mother of Aiden and AJ

SILAS

He loves to read books, play soccer, sing songs, dig in the garden and chase his grandpa's chickens and bunnies and our dog Orka. We are grateful that we found out about his illness so early in his life and are proud of our brave little son.

Natalie, mother of Silas

RESOURCES

A range of informative resources are available:

HUNTERSYNDROME.IN

Huntersyndrome.in is an informative online resource for patients and families, packed with videos and materials on Hunter syndrome, covering the disease itself, patient stories and advice. Please visit **Huntersyndrome.in** for more information.

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