There are grants and funds available to ensure that the work involved is affordable. An occupational therapist will consult on all aspects of any adaptations and assist the family in undertaking this process.

Will there be an impact on the child's education?

Education will continue to be important for the child and family and there will be many aspects that require consideration and significant assistance from those around them.

The Children and Families Act 2014 came into force in September 2014. The introduction of the 0-25 Education, Health and Care Plan should help children, young people and families affected by NCL. Education, Health and Care (EHC) Plans will gradually replace Statements of Special Educational Needs.

Children who do not yet have a Statement will have a statutory Education, Health and Care Needs assessment. An EHC Plan will be drawn up that is personalised to meet the education, health and care needs of the child.

It remains probable that many parents will continue to need guidance, understanding and support when trying to navigate the process of statutory assessment and the drawing up of the EHC Plan.

The BDFA has expertise in this field and can be approached by any parties seeking information or help.

The BDFA Educational Advisor may be able to provide specific support and can be contacted via **0800 046 9832** email: **admin@bdfa-uk.org.uk**

In what other ways can families be supported?

The realities of caring for a child who has CLN7 disease can place enormous strain on a family, both physical and emotional. It will impact upon all members in numerous ways and so being made aware that support is available to groups and individuals to help with the challenges that will be faced is important. This support extends to wider family members. There are several options to consider should families wish to explore ways of maximising the limited time available to share with their children. Contacting a charitable wish-granting organisation may lead to them being able to create some valuable and significant memories.

Where can I get additional information and support?

The BDFA offers support to any family member, friend, professional or organisation involved in caring for a child with CLN7 disease or any other form of NCL throughout the UK. We provide informed guidance and assistance as well as seeking to actively increase awareness of the disease and facilitate future research to identify potential therapies and ultimately a cure.

We organise conferences, workshops and are able to arrange connections with other affected families. The BDFA also coordinate a Small Grants Scheme that can provide assistance for a range of needs. The BDFA has a Support and Advocacy Partner who is able to assist with many of the issues highlighted in this document and can discuss each of them in greater detail and on a more personal basis. The BDFA family folder can also provide further specific information on CLN7 disease. The folder is free for all families and available to professionals at a cost of £25.

Please contact the **BDFA Family Support and Advocacy Partner** via our **Freephone Helpline: 0800 046 9832** or email: **support@bdfa-uk.org.uk** for further information and to order a copy of the family folder.

There are a number of local and national organisations that are also able to offer various forms of support and information that will be relevant to families. The BDFA can provide details and information about them.

It may also be appropriate for a referral to be made to a local children's hospice service, as this can offer an additional experienced and skilled source of holistic support.

Some of the information contained in this leaflet is based upon chapters in "The Neuronal Ceroid Lipofuscinoses (Batten Disease) 2nd Edition" by Goebel, Mole & Williams (Eds), Oxford University Press 2011 and is used with permission.

Permission has also been granted for the inclusion of additional information sourced from Dr. Ruth Williams (NCL2012 Abstract Book, Clinical Summaries, 2012)

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CLN7 Disease, Variant Late-Infantile

Are there any alternative names?

CLN7 disease, variant late-infantile may also be referred to as variant late-infantile CLN7 disease, alongside Variant Late Infantile Neuronal Ceroid Lipofuscinosis; though was more commonly known as Variant Late-Infantile Batten Disease.

What are Neuronal Ceroid Lipofuscinoses (NCLs)?

These refer to several different genetic life-limiting neurodegenerative diseases that share similar features. Although the different forms of NCL are sometimes described according to the age of the child at the onset of the disease, they are now better classified according to the gene identified as the cause e.g. CLN7 (gene) disease, variant late-infantile (age of onset), CLN3 (gene) disease, juvenile (age of onset).

What causes NCL?

Since the first genes causing NCL were identified in 1995, over 400 mutations in 14 different genes have been described that cause the various forms of NCL disease. Our cells contain thousands of genes that are lined up along chromosomes. Human cells contain 23 pairs of chromosomes (46 in total). Most genes control the manufacture of at least one protein. These proteins have different functions and include enzymes that act to speed up molecular chemical reactions. The NCLs are caused by abnormal genes, which are unable to produce the required proteins. As a result, the cells do not work properly and this leads to the development of symptoms associated with these diseases.

What specifically causes CLN7 disease?

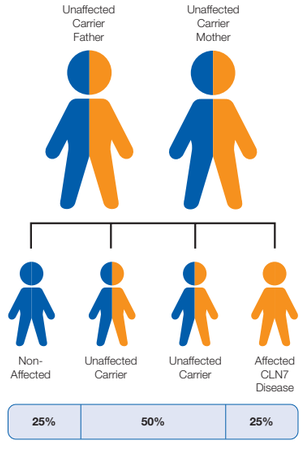
The gene called CLN7 and/or MFSD8 (CLN7) was discovered to be the cause of disease in 2007, and lies on chromosome 4. It encodes a protein, MFSD8, which belongs to a large group of proteins, the major facilitator superfamily (MFS). These proteins are found in cell membranes inside and around the cell and are involved in transporting small molecules across these membranes. Based on this knowledge, MFSD8 may also function in this way inside the cell however what it transports is not known at present.

How are NCLs inherited?

Most forms of NCL are inherited as "autosomal recessive" disorders. This is one of several ways that a trait, disorder, or disease can be passed down through families. An autosomal recessive disorder means that both copies of the gene are abnormal (one inherited from each parent) with neither working properly. The disease does not depend on the sex of an individual.

What are the chances of inheriting CLN7 disease?

CLN7 disease is inherited as an autosomal recessive disorder, which means that both chromosomes carry mutations in the CLN7 gene. Therefore both biological parents of a child with this diagnosis will be carriers of the disease but physically unaffected by it.



A child born to parents who both carry the autosomal recessive mutation in the CLN7 gene has a 25% (1 in 4) chance of inheriting the abnormal malfunctioning genes from both parents and developing CLN7 disease.

They will have a 50% (1 in 2) chance of inheriting one abnormal gene, which would make them a carrier who is unaffected by the disease. There is a 25% (1 in 4) chance of the child being born with two normal genes and therefore being non-affected (not a carrier).

When it is known that both parents are carriers of the abnormal gene, we refer to there being a 2 in 3 chance of a child being a carrier, once it is established that they are unaffected by the disease.

With any pregnancy, the probability of a child inheriting one or both genes from their parents is the same each time, irrespective of any sibling's status.

How is it diagnosed?

Children will probably have been seen by a paediatrician and paediatric neurologist, because of symptoms such as seizures. A number of investigations will have been done to look for the cause of the seizures.

Blood samples will be taken for a number of investigations to identify the type of Batten disease. When viewed with an electron microscope, blood samples will usually show abnormal storage bodies in the cells. These products can have characteristic patterns, depending on the type of NCL.

Genetic testing is recommended to look for the exact mutation or mistake in the CLN7 gene. A blood or saliva sample will be taken to extract DNA from the cells for the test.

How common is it?

Approximately 1 - 2 children are diagnosed with CLN7 disease each year in the UK. We estimate there are currently less than 10 affected children in the UK. Children have been diagnosed with this condition in many countries and from a variety of ethnic backgrounds.

What are the symptoms and how does the disease progress?

Children appear to be healthy and develop normally for the first few years of life. Children with CLN7 disease can be very different from each other, making the disease course difficult to predict in individual cases. The first symptoms may be apparent early on in life, though might not be evident until after school entry. Developmental progress may begin to slow down and some children will be delayed in the development of their language skills. Challenging behaviour may be seen at an early stage, before other symptoms and so it is often only linked to the disease after diagnosis is made.

Usually the onset of epilepsy will take place between 3 and 7 years of age. The seizures may be varying in nature and include drops, vacant spells (absences) or motor seizures with violent jerking of the limbs and loss of consciousness. Initially, seizures may be successfully managed with medication, yet they will always recur and often become difficult to control.

Children tend to become unsteady on their feet and may frequently fall. Gradually, skills related to walking, playing and speech are lost with children becoming less able and increasingly dependent.

Later children with CLN7 disease usually have myoclonic (rapid involuntary muscle spasm) jerks of their limbs and are prone to erratic movements of their head (nods). They may have difficulty sleeping and often become distressed around this time, usually without obvious reason. Their vision gradually deteriorates, with its loss being ultimately inevitable.

The nature of the disease means that children will become completely dependent on families and carers for all of their daily needs, however the rate of progression to this state can vary significantly between individuals (the period between 9 - 11 years of age often sees rapid advancement of symptoms). In order to ensure they receive adequate nutrition, they will require a specialist feeding tube (gastrostomy). There will be noticeable stiffening of their arms and legs, whilst some children become prone to frequent chest infections.

Sadly most children who have CLN7 disease die during late childhood or their teenage years, though there are exceptions.

Are there any treatments?

Currently there is no cure for CLN7 disease and therefore specialist symptom management and therapy is essential to assist in maintaining a good quality of life for children and their families. Holistic support for parents, siblings and wider family members is extremely important throughout their journey.

Epilepsy can be difficult to treat and therefore obtaining complete control of seizures is not always possible. Anticonvulsant medications will be necessary from the early stages of the disease process that may respond to phenobarbital and valproic acid. Some patients may respond to levetiracetam as well.

Myoclonic jerks (involuntary muscle spasms) are common, though should not be confused with epileptic seizures. They can interfere with rest and sleep as well as being distressing for children and their families. Along with spasticity (unusually tight or stiff muscles), these symptoms can be managed with baclofen and tizanidine. In order for medication to be sufficient the responsible doctor may need to prescribe higher dosages than are usual for those who do not have CLN7 disease.

Various professionals including doctors, nurses, physiotherapists, occupational therapists and speech and language therapists should be involved in the care of children with CLN7 disease. They will work collaboratively and in conjunction with the family to provide a holistic approach to care.

Support and treatment will be needed for a range of issues including progressive difficulties with chewing and swallowing, constipation, hydration, respiratory function, oral secretions, motor disorder and sleep disturbance. Attention to posture, seating, skin and mouth care is essential and children will require additional nutritional support that will include consideration of a gastrostomy.

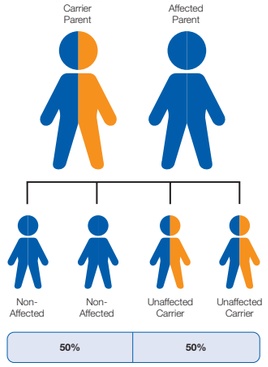
What research is being done?

Research into possible methods for treating the disease is on going with various theoretical approaches being considered and investigated. Gene therapy for CLN7 disease is being investigated, which aims to introduce a copy of the defective gene into cells so that they can then produce a correct functioning protein within the brain and the eye. This forms part of the on-going BATCure project however it is still in the early stages of development.

Researchers in the UK and worldwide are researching potential drugs which may alleviate some of the symptoms of the disease or slow its progression.

For updates and information regarding developments in research please visit the BDFA website: **www.bdfa-uk.org.uk**, BATCure website: **www.batcure.eu** via **0800 046 9832**, email: **research@bdfa-uk.org.uk**

What are the genetic considerations?



The age that CLN7 disease is usually diagnosed in a child means that some families will have younger siblings who may be affected but have not displayed any symptoms.

It may also be possible that older unaffected siblings are carriers of the disease and may want to understand how CLN7 disease may affect their family choices when they are older.

When only one parent is a carrier of the abnormal gene, and the other is non-affected, there is a 50% (1 in 2) chance that any child will be an unaffected carrier.

If parents are considering having additional children, they can access specialist advice and support from their local clinical genetics service following a referral from their GP. Prenatal testing may be possible in the early stages of any future pregnancy.

Is support available to families?

As soon as possible following a diagnosis of CLN7 disease, families should be offered support from various professionals attached to their local health, social, educational services and the BDFA Support and Advocacy Partner. Ideally a "Team Around the Child" will be formed, with one of the professionals appointed as a Keyworker for the family.

The child's needs should be discussed with the parents and assessed by the team. The team will work together to ensure that the child and family receive the on-going care and support they need and that their choices are taken into account.

A child and family's needs will inevitably change as the disease progresses. As such, it is often helpful if a clear process for regular planned reviews is identified and that a system is established for enabling additional reviews as and when they are deemed necessary. As the rate or pattern of the progression of the disease for each child remains uncertain, an individualised plan of care and support is essential.

The BDFA is able to provide various forms of holistic support and can be contacted via **0800 046 9832** email: **support@bdfa-uk.org.uk**

How can families manage the financial challenges?

Caring for a child with CLN7 disease will bring additional financial challenges. It is vital that families are well informed about the full level of economic assistance available and the support that they are entitled to. They may well need help and guidance in accessing benefits and other sources of assistance. The professionals and services supporting the family should provide advice and guidance. The BDFA can also support families with these issues in various ways, the Small Grants Scheme being one example.

What are the practical implications for the family?

As the disease progresses, specialist equipment and aids will become necessary and this is another area where the family will need help. Items are likely to include specialist seating, buggies/wheelchairs, bathing and toileting aids, hoisting equipment and a specialist bed/mattress. Professionals will play a key role in ensuring that these and other items are provided in a timely manner following proper assessment of the individual child's needs.

It is likely that changes will be needed in the home environment to enable the family to appropriately care for a child with CLN7 disease. These may include installing ramps, widening doorways and providing suitable floor surfaces. A purpose-built wet room with a specialist bath or shower is commonly needed and there are various other aspects that will require consideration.

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