Children's Liver Disease Foundation

fighting childhood liver disease

Alpha-1 Antitrypsin Deficiency

A Guide

An explanation of what alpha-1 antitrypsin deficiency is, its causes and how it is diagnosed and treated

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Alpha 1 antitrypsin deficiency

This information has primarily been written for:

Parents/carers of children with alpha-1 antitrypsin deficiency

Others may also find this information useful:

- Young people with alpha-1 antitrypsin deficiency
- Healthcare professionals who would like to find out more about the condition

You may find it helpful to also read the following CLDF leaflets:

- An Introduction to Liver Disease

What is alpha-1 antitrypsin?

Alpha-1 antitrypsin is a protein in the body. It is made from the food we eat. It is mainly produced by the liver and is then circulated around the body in the bloodstream.

It can be written as alpha-1 or α1AT.

Why is the alpha-1 antitrypsin protein important?

It is not fully understood why we need alpha-1 antitrypsin or what its main task in the body is. Research has shown that it has a protective role in preventing tissue damage during acute inflammation.

Proteases are chemicals in the body known as enzymes. They break proteins down. Alpha-1 antitrypsin stops the proteases from breaking down healthy tissues in the body.

The body makes proteases in response to infections and irritants entering the body. Without the protective effect of alpha-1 antitrypsin, these proteases can cause tissue damage. This can happen over a period of many years. The lungs can be particularly affected because they may be exposed to chemicals in the air (e.g. tobacco smoke) which can speed up damage.

Alpha 1 antitrypsin deficiency

What is alpha-1 antitrypsin deficiency?

Individuals with alpha-1 antitrypsin deficiency produce a slightly different form of alpha-1 antitrypsin protein in the liver.

This abnormal alpha-1 antitrypsin becomes trapped in the liver. This means that it is not carried to other parts of the body so individuals usually, but not always, have low amounts of alpha-1 antitrypsin in their blood. This can lead to damage to the lungs and the liver. This leaflet focuses on the potential damage to the liver.

Around one out of ten children who have alpha-1 antitrypsin deficiency have problems with their liver. Many people affected by the condition will get some scarring of their liver but most will not develop liver disease.

What are the effects of alpha-1 antitrypsin deficiency?

Some people seem to suffer no ill effects whatsoever. However, others do and these can include:

- Emphysema
  Some people will stay healthy for years but then in their late twenties, or later, develop breathing difficulties due to a condition called 'emphysema'. The disorder can lead to lung damage and early death. Cigarette smoking, including passive smoking, is thought to be a major contributory factor in causing emphysema.

- Liver damage
  Children can develop inflammation of the liver which can cause liver damage. Inflammation of the liver is called hepatitis but it is not infectious. The liver problem usually becomes apparent in the first few months of a baby's life and may be referred to as neonatal hepatitis.

Some of the signs and symptoms which may be seen at the time of diagnosis are:

- Jaundice (yellowing of the skin/the whites of the eyes)
- Persistently yellow urine
- Pale stools (poo)
- Poor weight gain
- Bleeding, for example, from the tummy button or nose
- Ascites (an abnormal collection of fluid in the abdomen) and portal hypertension (high blood pressure in the blood vessels around the liver). There is a leaflet available from CLDF which discusses these in more detail.

Are there any treatments or cures for liver disease associated with alpha-1 antitrypsin deficiency?

At the moment there is no specific treatment or cure for alpha-1 antitrypsin deficiency. Despite this the medical teams caring for your child will monitor and manage any symptoms caused by it.

It may be necessary to make a change to your child's diet. This will be done by a dietitian. Some points to bear in mind are:

- Babies frequently do better with a special milk formula rather than ordinary milk or breast milk alone. The special milks are more easily absorbed. A specialist dietitian can provide advice on increasing the calories your baby takes in by adding extra milk feeds to their diet.

- Older children may require extra calories which can be given in the form of high calorie drinks.

- Changes to the diet are often necessary because babies and children with damaged livers have poor bile production. This means they often don't absorb all of the food that they eat. They can lose weight or have difficulty in gaining weight.

- Children may be given extra vitamins, especially vitamin K, to help the blood to clot normally.

For more information on nutrition you can see CLDF's Nutrition leaflet or speak to your child's dietitian.

What will be monitored in a child with alpha-1 antitrypsin deficiency?

Their growth and development will be monitored. Following a new diagnosis babies should be weighed weekly by their health visitor. A member of the liver team will contact the child's health visitor to give them further advice.

How well the liver is working will also be monitored. This can include blood tests, scans and sometimes a liver biopsy. Testing liver function can make sure any complications are recognised at an early stage and are treated quickly.

As a child's condition becomes more stable, they will probably have fewer hospital visits.

CLDF has a leaflet called "An Introduction to Liver Disease" which contains more information on general tests.

What is the likelihood of a child with alpha-1 antitrypsin deficiency developing serious liver problems?

There is no definite way to know whether a child will develop liver problems. A large study was carried out in Sweden in 1976 which showed that approximately 15 out of 100 (15%) children with alpha-1 antitrypsin deficiency had liver disease in infancy.

From the follow-up of these children it was found that:

- 25 out of 100 (25%) children had no disease symptoms at the age of 10.
- 45 out of 100 (45%) children had continuing evidence of liver disease in their blood test results.
- 5 out of 100 (5%) children needed a liver transplant in the first year of life.
- 25 out of 100 (25%) children needed a liver transplant at some point in their childhood.

A liver biopsy will show the degree of fibrosis (scarring) and liver damage.

If the liver disease gets worse and if there are problems caused by scarring on the liver (cirrhosis) then liver transplantation may be recommended. It's important to know that whilst liver transplantation is a big step, the results of liver transplantation in children are excellent. There is now over 95% one year survival rate reported by transplant centres.

CLDF has a leaflet called "Liver Transplantation – an overview" which explains liver transplantation in more detail.

A few children and adults with alpha-1 antitrypsin deficiency are only diagnosed with alpha-1 antitrypsin deficiency when they have problems caused by scarring in the liver. They may have had very mild jaundice or even no jaundice as young children.

What are the signs and symptoms to look out for in a child or young person with alpha-1 antitrypsin deficiency?

- Failure to gain weight or weight loss
- Constant tiredness or lethargy
- Deepening or reappearance of jaundice
- A swollen abdomen. This may be due to an enlarged spleen or an abnormal collection of fluid. Enlargement of the liver and the spleen can also be signs of alpha-1. Sometimes the baby's tummy may be obviously bigger than usual or it may only be noticed when a doctor examines your baby.
- Recurrent nose bleeds
- Vomiting blood
- Blood in the stool. This may be black or red
- Swollen ankles, especially in the evenings

If portal hypertension is present due to cirrhosis, then medicines such as aspirin and ibuprofen should be avoided as they can make bleeding in the gut more likely. Paracetamol (Calpol) is a safer alternative.

What causes alpha-1 antitrypsin deficiency?

Alpha-1 antitrypsin deficiency is an inherited condition. It is passed on from parents to their children through their genes.

Genes are made up of DNA. They are the instructions contained in the female egg and the male sperm which determine the colour of our skin, eyes, hair and every other detail of our body. Genes come in pairs: we inherit one from our mother and one from our father. An estimated 1 in 40 of the European population are carriers of a gene which causes alpha-1 antitrypsin deficiency.

Alpha-1 antitrypsin deficiency occurs when a baby inherits an abnormal gene from each parent. Children with two abnormal genes don't produce alpha-1 antitrypsin properly.

The most common version of the gene is known as the M phenotype. This produces normal levels of alpha-1antitrypsin protein.

There are a number of different abnormal genes which may cause alpha-1 antitrypsin deficiency. The Z phenotype is the most common abnormal version of the gene. This gene causes alpha-1 antitrypsin disease.

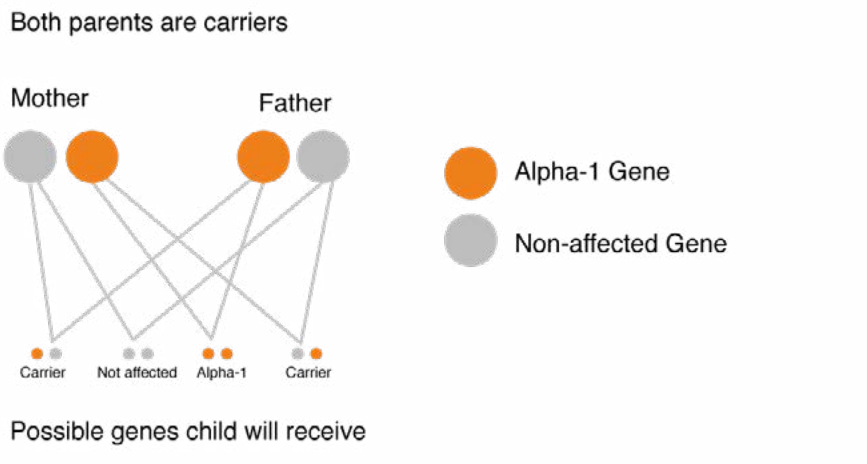
Another version of the gene, the S phenotype, is less common and does not appear to lead to childhood liver disease.

What are the chances of a child inheriting alpha-1 antitrypsin disease from their parents?

Both parents must have at least one copy of the abnormal alpha-1 antitrypsin deficiency gene in order for their child to inherit the disease.

When both parents are carriers:

When an individual is a carrier it means they have one copy of the affected gene but they do not have the disease.



If both parents are carriers then there is a chance that each parent will pass on the affected gene.

1 out of 4 times, the child of two carriers will inherit two abnormal genes - one gene from each parent. These children will have alpha-1 antitrypsin deficiency.

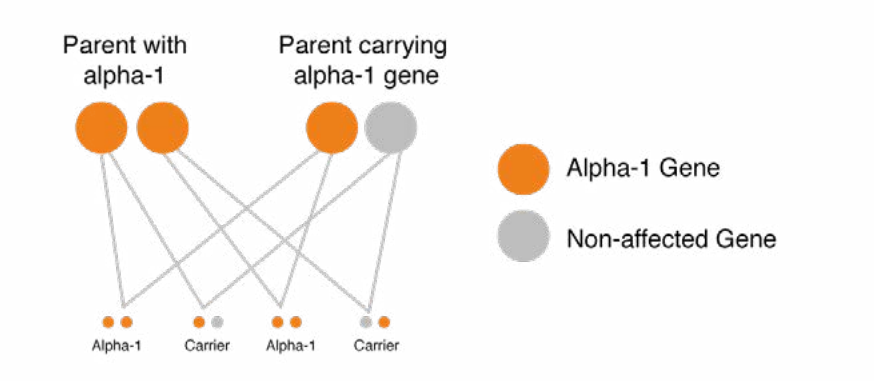
1 out of 4 times, their child will inherit two normal genes. These children will not have any alpha-1 antitrypsin deficiency genes and will be clear of the disease.

2 out of 4 times, their child will inherit one normal gene and one abnormal gene. This child will be a carrier like their parents.

When one parent is a carrier and the other parent has alpha-1 antitrypsin deficiency:

2 out of 4 times, their child will have alpha-1 antitrypsin deficiency.

2 out of 4 times, their child will inherit one normal gene and one abnormal gene. This child will be a carrier like their parents.



If both parents have alpha-1 antitrypsin deficiency:

All children will have alpha-1 antitrypsin deficiency.

Older brothers and sisters of affected children can be tested to see whether they have undiagnosed alpha-1 antitrypsin deficiency, are carriers, or are completely clear.

What is a genetic counsellor?

Genetic counselling is available for individuals affected by alpha-1 antitrypsin deficiency who are planning to have children or are thinking of having siblings of an affected child tested.

Genetic counsellors are specialists in the study of genes who are trained to advise parents who have a child, or children, with a genetically inherited problem or have one themselves. They can provide advice regarding having children in the future and discuss genetic testing for the family.

Many parents find it extremely useful to talk to a genetic counsellor before making a decision regarding whether they would like to go ahead with genetic testing or not and find it useful to discuss the pros and cons with a genetic counsellor. It's advisable to get a referral from your GP or your child's liver team.

Living with alpha-1 antitrypsin deficiency

Alpha-1 antitrypsin deficiency can affect children and young people differently. Whilst some children may become very unwell and require a liver transplant, others lead almost completely normal lives and only visit their liver centre once a year for a check-up. As mentioned previously, the outcomes after a liver transplant in children are excellent and post-transplant children and young people can go on to achieve great things.

CLDF supports families and young people with alpha-1 antitrypsin deficiency right from diagnosis to an individual's 25th birthday. To find out more about how we can support you and your family visit childliverdisease.org or see our contact details on the back page to get in touch.

How we produce information

Our information resources are written, edited and reviewed with the help of medical experts and families living with liver disease.

Thanks

We would like to thank staff at each of the specialist paediatric liver centres: Birmingham Children's Hospital, King's College Hospital and Leeds Children's Hospital. We would also like to thank the families who helped us produce this information.

Disclaimer

This resource provides general information but does not replace medical advice. It is important to contact your medical team if you have any worries or concerns.

Feedback and information sources

Your feedback is important to us and will help us improve our information. To provide feedback, or for more information on how it was developed, email info@childliverdisease.org.

This leaflet has been reviewed in October 2020.

It is due to be updated by October 2023.

Children's Liver Disease Foundation

Children's Liver Disease Foundation (CLDF) is the UK's leading organisation dedicated to fighting all childhood liver diseases.

CLDF provides information and support services to young people up to the age of 25 with liver conditions and their families and is a voice for everyone affected.

CLDF is here for you, whether you want to talk, share with others, or just belong to a group of people who cares, knows what it's like and are fighting to make a difference.

Are you a young person up to the age of 25?

Contact the Young People's Team:
Phone: 0121 212 6024 **Email:** youngpeople@childliverdisease.org

Are you the parent or carer of a child or young person with a liver condition?

Contact the Families Team:
Phone: 0121 212 6023 **Email:** families@childliverdisease.org

Would you like to help us support the fight against childhood liver disease? Please help us to continue to support children, young people and families now and in the future.

Contact the Fundraising Team:

Email: fundraising@childliverdisease.org

Use this QR code to donate

Tel: 0121 212 3839
Email: info@childliverdisease.org
Website: www.childliverdisease.org

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