



IVA (Isovaleric Acidemia)

What is it?

IVA stands for isovaleric acidemia. It is one type of organic acid disorder. People with IVA have problems breaking down an amino acid called leucine from the food they eat.

What causes it?

In order for the body to use protein from the food we eat, it is broken down into smaller parts called amino acids. Special enzymes then make changes to the amino acids so the body can use them.

IVA occurs when an enzyme, called isovaleryl-CoA dehydrogenase, is either missing or not working properly. This enzyme's job is to help break down a substance called isovaleryl-CoA. It is made in the body when the amino acid leucine is broken down. When a child with IVA eats food containing leucine, a substance called isovaleric acid builds up in the blood and causes problems. Leucine is found in all foods that contain protein.

If IVA deficiency is not treated, what problems occur?

The effects of IVA vary from person to person. There are two main forms of the condition. About half of all babies start showing symptoms shortly after birth. The other form, called chronic-intermittent, starts later in infancy or childhood.

IVA in Babies

Babies with IVA seem healthy at birth. Often, the first symptoms start between 1 day and 2 weeks of age.

IVA causes episodes of illness called metabolic crises. Some of the first symptoms of a metabolic crisis are:

- 1) Poor appetite.
- 2) Extreme sleepiness or lack of energy.
- 3) Vomiting.
- 4) Problems staying warm.
- 5) An odor similar to sweaty feet.

Other symptoms can then follow:

- 1) Increased levels of acidic substances in the blood, called metabolic acidosis
- 2) High levels of ammonia in the blood
- 3) Ketones in the urine
- 4) Low platelets
- 5) Low level of white blood cells
- 6) Seizures
- 7) Swelling of the brain
- 8) Bleeding in the brain
- 9) Coma, sometimes leading to death

If not treated, many babies die during their first metabolic crisis. In those who survive, repeated episodes of metabolic crisis can cause brain damage. This can result in lifelong learning problems or mental retardation.

Chronic/Intermittent IVA

Symptoms often start around age 1. Some children, though, do not have symptoms until later in childhood.

Episodes of metabolic crisis can be brought on by illness or infection or by eating large amounts of protein. When a child is ill, body protein is broken down for energy. In a child with IVA, this can cause high levels of isovaleric acid and results in a metabolic crisis.

Between episodes of metabolic crisis, children with IVA are usually healthy.

Some people have very mild or no symptoms and are found to be affected only after a brother or sister is diagnosed.

What is the treatment for IVA?

Your baby's primary doctor will work with a metabolic doctor and a dietician to care for your child.

Prompt treatment is needed to prevent metabolic crises and the health effects that follow. You should start treatment as soon as you know your child has IVA. Certain treatments may be advised for some children but not others. Treatment usually is needed throughout life.

The following treatments are recommended for babies and children with IVA:

Low-Leucine Diet, Medical Foods and Formula

Most children need to eat a diet made up of foods low in leucine. Special medical foods and a leucine-free formula are usually part of the diet. Your dietician will create a food plan that contains the right amount of protein, nutrients, and energy to keep your child healthy. A special food plan should be continued throughout life.

Low-Leucine/Low Protein Diet

Foods high in protein (and leucine) that may need to be avoided or limited include:

- 1) Milk and dairy products.
- 2) Meat and poultry.
- 3) Fish.
- 4) Eggs.
- 5) Dried beans and legumes.
- 6) Nuts and peanut butter.

Eating large amounts of these foods can cause isovaleric acid levels to rise, causing illness.

Many vegetables and fruits have only small amounts of protein and can be eaten in carefully measured amounts.

Do not remove all protein from the diet. Children with IVA need a certain amount to grow properly. Any diet changes should be under the guidance of a dietician.

Medical Foods and Formula

There are medical foods such as special low-protein flours, pastas and rice that are made especially for people with organic disorders. Your dietician will tell you how to use these foods to supplement your child's diet.

In addition to a low-protein diet, many children are given special leucine-free medical formula.

Your metabolic doctor and dietician will decide whether your child needs this formula. Some states offer help with the cost; others require private insurance to pay for the formula and other special medical foods.

Medications

Glycine is an amino acid that helps the body get rid of isovaleric acid. It often is given as a supplement to children with IVA. It may help prevent metabolic crises. Your doctor will tell you whether your child needs glycine and how much to use.

Some children may benefit by taking L-carnitine. This is a safe and natural substance that helps the body cells make energy. It also helps the body get rid of isovaleric acid and other harmful wastes. Your doctor will decide whether your child needs L-carnitine. Unless you are advised otherwise, use only L-carnitine prescribed by your doctor.

Do not use any medication without checking with your doctor.

Children with symptoms of a metabolic crisis need medical treatment right away. They may

need to be treated in the hospital. During a metabolic crisis, children may be given bicarbonate, glucose and other medications by IV to help reduce the acid levels in the blood.

Call Your Doctor at the Start of Any Illness

In some children, even minor illnesses such as a cold or the flu can lead to a metabolic crisis. In order to prevent problems, call your doctor right away when your child has any of the following:

- 1) Loss of appetite
- 2) Vomiting
- 3) Diarrhea
- 4) Infection or illness
- 5) Fever

Children with IVA need to eat more carbohydrates and drink more fluids when they are ill – even if they're not hungry – or they could have a metabolic crisis. In addition, they need to avoid eating protein when they are ill.

Children who are sick often don't want to eat. If they can't eat, or if they show signs of a metabolic crisis, they may need to be treated in the hospital. Ask your metabolic doctor if you should carry a special travel letter with medical instructions for your child's care.

What happens when IVA is treated?

With prompt and careful treatment, children with IVA have a good chance to live healthy lives with typical growth and development.

Even when treated, some children still have repeated bouts of metabolic crisis. This can lead to lifelong learning problems or mental retardation. As they get older, children tend to have fewer metabolic crises.

What causes the isovaleryl-CoA dehydrogenase enzyme to be absent or not working correctly?

Genes tell the body to make various enzymes. People with IVA have a pair of genes that do not work correctly. Because of the changes in

this pair of genes, the isovaleryl-CoA dehydrogenase enzyme either does not work properly or is not made at all.

Is IVA inherited?

IVA is inherited in an autosomal recessive manner. It affects both boys and girls equally.

Everyone has a pair of genes that make the isovaleryl-CoA dehydrogenase enzyme. In children with IVA, neither of these genes works correctly. These children inherit one nonworking gene for the condition from each parent.

Parents of children with IVA rarely have the condition themselves. Instead, each parent has a single nonworking gene for IVA. They are called carriers. Carriers do not have IVA because the other gene of this pair is working correctly.

When both parents are carriers, there is a 25 percent chance in each pregnancy for the child to have IVA. There is a 50 percent chance for the child to be a carrier, just like the parents. And, there is a 25 percent chance for the child to have two working genes.

What other testing is available?

Special tests using blood, urine or skin samples can be done to confirm IVA. Talk to your metabolic doctor or genetic counselor if you have questions about testing.

Can you test during pregnancy?

If both gene changes have been found in your child, DNA testing can be done during future pregnancies. An enzyme test using cells from the fetus also can be done during pregnancy.

Parents may choose to have testing during pregnancy or wait until birth to have the baby tested. A genetic counselor can talk to you about your choices and answer questions about prenatal testing or testing your baby after birth.

Can other members of the family have IVA or be carriers?

Having IVA

The brothers and sisters of a baby with IVA may have a small chance of being affected, even if they haven't had symptoms. Finding out whether other children in the family have this condition is important because early treatment may prevent serious health problems. Talk to your metabolic doctor or genetic counselor about testing your other children.

IVA Carriers

Brothers and sisters who do not have IVA still have a chance to be carriers like their parents. Except in special cases, carrier testing should be done only in people older than 18.

Each of the parents' brothers and sisters has a 50 percent chance to be a carrier. It is important for other family members to be told that they could be carriers. There is a small chance they are also at risk to have children with IVA.

When both parents are carriers, newborn screening results are not sufficient to rule out the condition in a newborn baby. In this case special diagnostic testing should be done in addition to newborn screening.

Can other family members be tested?

Diagnostic Testing

Brothers and sisters of a child with IVA can be tested using blood, urine or skin samples.

Carrier Testing

If both gene changes have been found in your child, other family members can have DNA testing to see if they are carriers.

If DNA testing is not possible or would not be helpful, other methods of carrier testing may be available. Your metabolic doctor or genetic counselor can answer your question about carrier testing.

How many people have IVA?

About one in every 230,000 babies in the United States is born with IVA.

Does IVA happen more frequently in a certain ethnic group?

IVA does not happen more often in any specific race, ethnic group, geographical area or country.

Does IVA go by any other names?

IVA is sometimes called:

- 1) Isovaleric acid CoA dehydrogenase deficiency.
- 2) IVD deficiency.
- 3) Isovaleryl CoA carboxylase deficiency.

Where can I find more information?

Organic Acidemia Association

www.oaanews.org

Save Babies Through Screening Foundation

www.savebabies.org

Children Living with Inherited Metabolic Diseases (CLIMB)

www.climb.org.uk

National Coalition for PKU and Allied Disorders

www.pku-allieddisorders.org

Genetic Alliance

www.geneticalliance.org

Children's Special Health Services (CSHS)

State Capitol Judicial Wing

600 E. Boulevard Ave., Department 301

Bismarck, ND 58505-0269

Toll Free: 800.755.2714

701.328.2436

Relay TDD: 701.328.3975

CSHS website: www.ndhealth.gov/CSHS

North Dakota Department of Health website:

www.ndhealth.gov

Family support resources available from CSHS:

- Guidelines of Care Info
- Family Support Packet
- Financial Help Packet
- Insurance Fact Sheet

Family Resources

Family to Family Network
Center for Rural Health
University of North Dakota
School of Medicine and Health Sciences
P.O. Box 9037
Grand Forks, ND 58202-9037
Toll Free: 888.434.7436
701.777.2359
Fax: 701.777.2353
E-mail: NDF2F@medicine.nodak.edu
www.medicine.nodak.edu/crh

Pathfinder Services of ND
Pathfinder Family Center
1600 2nd Ave. SW, Ste. 19
Minot, ND 58701
Toll Free: 800.245.5840
701.837.7500
Relay TDD: 701.837.7501
E-mail: ndpath01@ndak.net
www.pathfinder.minot.com

Family Voices of North Dakota, Inc.
P.O. Box 163
Edgeley, ND 58433
Toll Free: 888.522.9654
701.493.2634
Fax: 701.493.2635
www.geocities.com/ndfv

**This fact sheet has general information.
Every child is different and some of these facts
may not apply to your child specifically.
Certain treatments may be recommended for
some children but not others. All children
should be followed by a metabolic doctor in
addition to their primary-care provider.

Acknowledgement

The North Dakota Department of Health
Newborn Screening Program thanks Star-G
Screening, Technology and Research in
Genetics for allowing us to utilize its material.

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North Dakota Department of Health
Newborn Screening Program
600 E. Boulevard Ave., Dept. 301
Bismarck, ND 58505-0200
800.472.2286 or 701.328.2493
www.ndhealth.gov/familyhealth