MCAD: Medium Chain acyl-CoA Dehydrogenase Deficiency

Medium-chain acyl-CoA dehydrogenase deficiency, also known as MCAD deficiency, is a type of genetic condition categorized as a fatty acid oxidation disorder (also known as a FAOD). The body usually gets its energy by breaking down, or burning, fats and sugars. People with FAODs cannot properly break down certain types of fats. For those with MCAD deficiency, the enzyme that is needed to break down medium-chain fats is unable to function properly. This prevents the body from creating needed energy during times of stress, illness, fasting, and exercise, which can lead to medical symptoms.

Alternative Names

- MCAD Deficiency

Cause and Genetics

People usually have two copies of the ACADM gene, one inherited from each parent. MCAD deficiency occurs when there are changes in both copies of the ACADM gene (autosomal recessive inheritance). Someone who has a change in only one copy of the ACADM gene is called a carrier, and they usually do not have any medical symptoms. If both parents are carriers, there is a 1 in 4 chance with each pregnancy that their child will have MCAD deficiency. Both males and females can have MCAD deficiency.

Frequency

MCAD deficiency is found worldwide, affecting approximately 1 in 20,000 births. The exact frequency of MCAD deficiency varies in different countries (for example, in northern Germany 1:4,900 babies have MCAD deficiency, but in Japan 1:51,000 babies have MCAD deficiency).

Signs and Symptoms

MCAD deficiency can cause a range of signs and symptoms. Whether your child was diagnosed via newborn screening may also affect when, if, and how these symptoms present. Always check with your doctor if your child is doing something out of "their" normal, as every child may present with symptoms a little differently. Signs and symptoms may include:

- Low blood sugar (hypoglycemia)
- Low ketones (hypoketosis)
- Coma and seizures (from hypoglycemia and hypoketosis)
- Enlarged liver (hepatomegaly)
- Vomiting

As children get older, they usually have fewer serious episodes. Some people with MCAD deficiency who were born before newborn screening, or were not picked up by newborn screening, may have mild signs and symptoms of MCAD deficiency when they are adults. These patients may also have episodes of muscle breakdown (rhabdomyolysis).

Diagnosis

Most cases of MCAD deficiency are identified by routine newborn screening. If newborn screening is

suggestive of MCAD deficiency, additional tests may be performed including:

- Measuring biochemical markers in the blood or urine, including an acylcarnitine profile
- Performing a genetic test to look for changes in the ACADM gene

Before newborn screening, about 25% of children died during their first episode/crisis. These deaths were often labeled as sudden infant death syndrome (SIDS). When a diagnosis is made early in life and management recommendations are followed, outcomes are generally very good.

If there is a family history of MCAD deficiency, or if parents are known carriers, prenatal testing can be performed on amniotic fluid (the fluid surrounding a baby) or chorionic villi (a specific part of the placenta).

Treatment and Management

Before beginning any treatment or therapy, please consult with your physician.

- Treatment and management of MCAD deficiency may include:
- Regular eating schedules to prevent low blood sugar (hypoglycemia)
- Avoidance of certain nutritional supplements (e.g., MCT oil)
- Modest reduction of fat to less than 30% of caloric intake
- Use of supplemental carnitine (controversial)
- Intravenous (IV) sugar-containing fluids called D10 during metabolic crisis

Parents should call their health care provider immediately if babies show symptoms like excessive sleepiness, vomiting, diarrhea, a fever, poor appetite, or an infection. Medical treatment should be sought immediately if there is loss of consciousness or severe confusion (decompensation), as these are signs of dangerously low blood sugar.

Patients should discuss the appropriate preparation for anesthesia with their metabolic team.

All patients should have an emergency protocol letter, written and signed by their doctor, that details their prescribed treatment during crisis and in emergency room settings, to manage severe episodes.

Clinical Trials

For specific details on other clinical trials, visit the MitoAction Clinical Trials page or www.clinicaltrials.gov.

Resources

- The National Institutes of Health: Medium-chain acyl-coenzyme A dehydrogenase deficiency - About the Disease
- The INFORM Network: MCAD Deficiency | Fatty Acid Oxidation Disorders Diagnosis
- National Organization for Rare Disorders (NORD): Medium Chain Acyl CoA Dehydrogenase Deficiency - NORD (National Organization for Rare Disorders)

Connecting with others who are impacted by a rare disease allows for important information to be shared about day-to day life, prevents isolation, and gives hope. Please contact MitoAction for peer support opportunities at 888-MITO-411 or email mito411@mitoaction.org. Other resources we recommend are:

- New Patient Kit for FAODs
- Planning and Preparation
- Monthly Expert Series
- Energy in Action Podcast

MitoAction does not provide medical advice, diagnosis, treatment, or legal advice. It is essential that all those living with or caring for someone with a Mitochondrial or FAOD disease have an emergency protocol letter. These letters, which are written and signed by a doctor, share details about prescribed treatment during crises and in emergency room settings. Always check with your doctor if you or your child has concerns as everyone may present with symptoms differently. Before beginning any treatment or therapy, please consult with your physician.