

ACUTE ILLNESS PROTOCOL
FATTY ACID OXIDATION DISORDERS
SHORT CHAIN Acyl-CoA DEHYDROGENASE (SCAD) DEFICIENCY

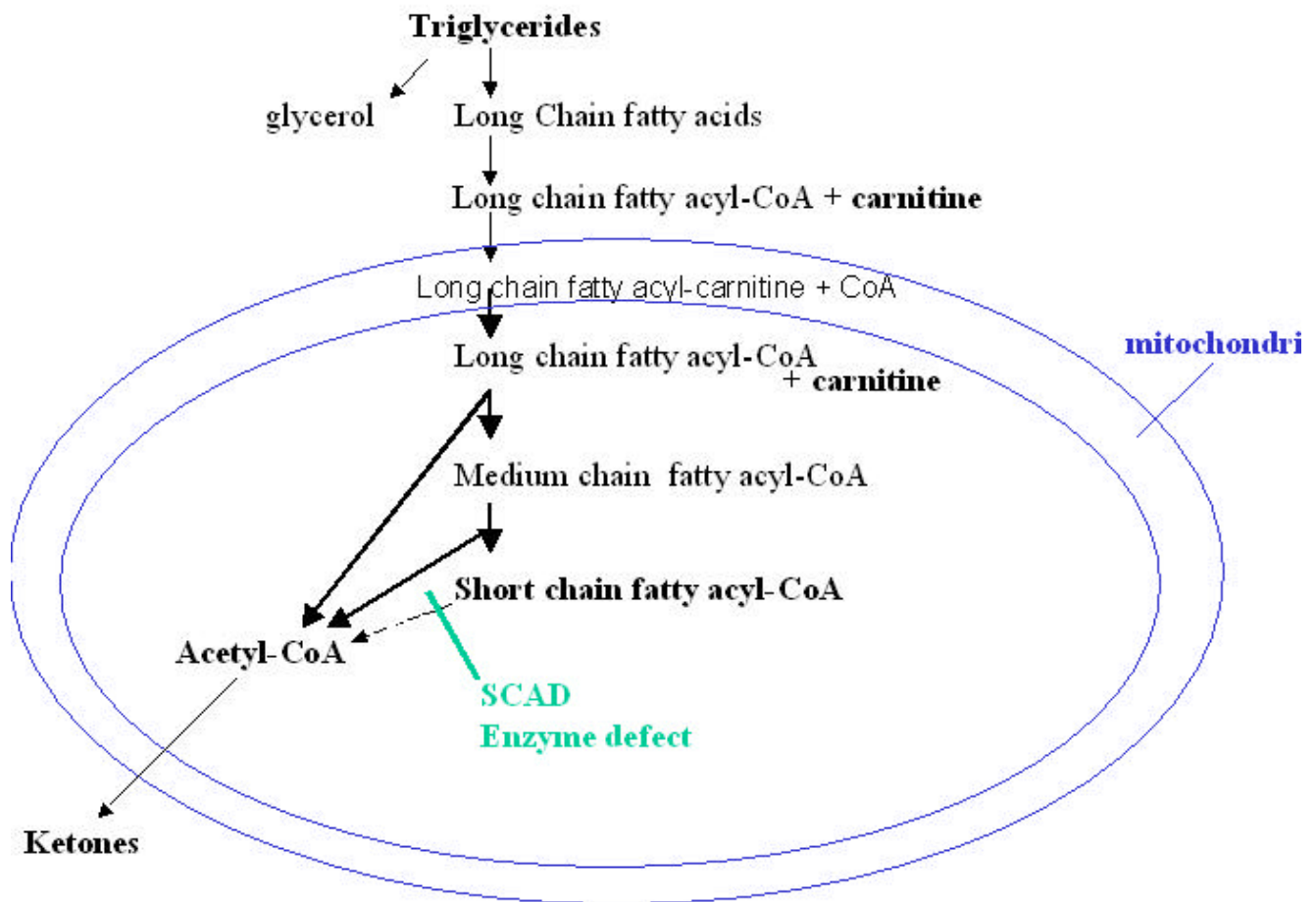
INTRODUCTION

Short Chain Acyl-CoA Dehydrogenase Deficiency (SCADD) is caused by an intramitochondrial defect in the β -oxidation of fatty acids. It can produce severe hypoglycemia and can be fatal.

PATHOPHYSIOLOGY

Below is the fatty acid β -oxidation metabolic pathway indicating the SCADD block.

Short chain acyl Co-A dehydrogenase deficiency (SCADD)



The pathophysiological process begins with reduced glucose intake as a result of a fasting state or increased energy needs from a catabolic state (infection, stress, fever, etc...) not sufficiently satisfied by caloric intake. The resulting hypoglycemia leads to mobilization of free fatty acids (FFAs), which enter the mitochondria via the carnitine cycle. In the mitochondria, as shown in the diagram above, the fatty acids in the acyl-CoA form are normally oxidized to acetyl-CoA, which is used to produce the ketones that can supply the energy needs to compensate for the lack of adequate glucose. A deficiency of SCAD, however, prevents β -oxidation and some, but not all, ketone formation. The block at SCAD also results in the accumulation of fatty acid intermediates that inhibit gluconeogenesis (thus preventing endogenous glucose production), have a toxic effect on the liver and produce metabolic acidosis.

PRESENTATION

- Asymptomatic
- Vomiting
- metabolic acidosis but USUALLY HAVE ketosis (unlike other FAODs)
- failure to thrive
- developmental delay
- hypotonia,
- chronic skeletal myopathy this is seen in some older patients.
- seizures
- encephalopathy
- 'Reye like' syndrome *of liver failure, hyperlacticacidemia and coma*
- Sudden death

When ill, patients with SCADD are at risk for developing metabolic acidosis and hypoglycemia. Carnitine levels are typically low. Hyperammonemia has been described. Whereas most other FAODs may be associated with hypoketotic hypoglycemia, metabolic crises due to SCADD are associated with significant ketosis.

Parents of children with diagnosed metabolic disorders know the early signs of decompensation in THEIR children. Listen to them !!!

ASSESSMENT

Assess for dehydration, fever, infection or any other physical stressor e.g. surgery, as a potential precipitant for metabolic decompensation. As a rule, decompensation occurs more quickly in infants but children and adults, though more resistant, are still at risk of sudden death.

- **Blood glucose**
- **Electrolytes, CO₂ and blood gas**
- **Ammonia** (1.5 ml blood in sodium-heparin tube sent STAT to lab on ice)
- **LFTs** (AST,ALT,AlkPO₄ PT,PTT, bilirubin)
- **CPK**
- **Urinalysis including ketones**
- **Carnitine, plasma**

* * ALL siblings of known cases should be tested for SCADD whether or not they have a history of symptoms.

TREATMENT

1. INDICATION FOR IV (NEVER less than 10% dextrose IV infusion)
(One or more indication is sufficient for IV)

- Vomiting
- Hypoglycemia
- Poor PO intake
- Dehydration Do not rely on urinary ketones as indicating dehydration!
- Decreased alertness
- Metabolic Acidosis

Start 10% glucose continuous infusion at 1.5x maintenance, to provide 7-8mg/kg/min.

2. HYPOGLYCEMIA

Push 25% dextrose 2ml/kg and follow with a continuous 10% dextrose infusion at 1.5x maintenance, to provide 7-8 mg/kg/min glucose.

3. METABOLIC ACIDOSIS (Bicarbonate level <16mEq/L)

Must be treated aggressively with IV sodium bicarbonate (1mEq/kg). Treating conservatively in the expectation of a re-equilibration of acid/base balance as other biochemical/clinical parameters are normalized can lead to tragic consequences.

4. PRECIPITATING FACTORS

Should be treated aggressively to help minimize further catabolism

5. APPARENTLY WELL

If drinking oral fluids well, and none of the above factors present, there is no need for emergent IVI. But history of earlier vomiting, pyrexia, or other stressor should be taken seriously and a period of observation undertaken to ensure that PO fluids are taken frequently and well tolerated, with glucose status monitored periodically.

POST EMERGENCY MANAGEMENT

1. Child unable to take/maintain PO intake

- Start, or continue, 10% glucose continuous infusion at 1.5x maintenance.
- Blood glucose and acid/base status should be monitored regularly. If the child is physically stressed keep the blood sugar levels elevated (glucose levels should be kept between 120-170 mg/dl)

2. Carnitine

The use of carnitine in FAODs is controversial and there are concerns that excessive long chain acylcarnitines which may be produced may induce arrhythmias. Consult with the metabolic physician for guidance regarding this in each individual case.

3. DO NOT ADMINISTER LIPIDS IN ANY FORM

4. Avoidance of fasting when stop IVI

This may include complex carbohydrate in the form of cornstarch supplementation to get through the night as the child gets older; and a high carbohydrate/low fat diet.

The cornerstone of SCADD chronic management includes

- avoidance of fasting (this may include complex carbohydrate in the form of cornstarch supplementation to get through the night as the child gets older)
- high carbohydrate/low fat intake
- Early detection of physiologic stresses inc. infection, surgery with especial attention to REGULAR feedings/source of glucose AROUND the clock.

Any questions about the patient or this protocol please call or have paged the Genetics/Metabolism Fellow-on-call or, failing this, the Metabolic Attending on call at your hospital or nearest pediatric tertiary care center.

Additional information may be obtained via OMIM at
<http://www.ncbi.nlm.nih.gov/htbin-post/Omim/dispmim?201470>