

**Disease Name:**

**CARNITINE TRANSPORTER DEFICIENCY**  
(SYSTEMIC CARNITINE DEFICIENCY; CARNITINE DEFICIENCY, PRIMARY;  
CARNITINE UPTAKE DEFECT; CUD)

**Classification:** Fatty acid oxidation defect

**Genetic Information:**

**Inheritance:** Autosomal recessive  
**Population Incidence:** Uncertain incidence in general population  
**Ethnic Incidence:** 1:40,000 live births in Japan  
**Gene & Location:** 5q31.2-32- SLC22A5 gene- OCTN2 protein  
**Common Mutation:** No known common mutations  
**OMIM #** #212140; \*603377

**Disease Information:**

**Symptom Onset:** Two forms, one with neonatal onset between 3-30 months of age, late onset form starts from 1-7 years of age.

**Symptoms:** Highly variable presentation, even within affected family members. Fifty percent of patients develop multiple attacks of acute encephalopathy, with vomiting, confusion, and stupor progressing to coma between birth and 30 months of age. Infants display hypoketotic hypoglycemia, hyperammonemia, elevated liver functions; some have cardiomyopathy (generally dilated) and/or skeletal muscle weakness. A few patients who have not had documented episodes of hypoglycemia have presented with nonspecific developmental delay. Another cause of sudden unexpected infant death. The other fifty percent present with progressive dilated cardiomegaly between 1-7 years of age. They have associated skeletal muscle weakness, but no evidence of hypoglycemia. Cognitive development is not impaired. Several patients have had anemia that did not respond to iron therapy. Others have had hepatomegaly, lipid deposits in muscle and/or liver steatosis.

**Physical Findings:** No particular dysmorphisms.

**Treatment:** Carnitine supplementation is lifesaving and curative. Carnitine and avoidance of fasting relieves the episodes of hypoglycemia and cardiomegaly resolves over several months of therapy. A low fat, high carbohydrate diet has been used in some cases, but must not be used alone.

<b>Natural History without treatment:</b>	Patients develop multiple attacks of acute encephalopathy, with vomiting, confusion, and stupor progressing to coma. Some patients, with no obvious hypoglycemia, have had developmental delay. Another cause of sudden unexpected infant death. The cardiomyopathy is progressive if untreated and leads to failure and death. Patients may be completely asymptomatic if not stressed.
<b>Natural History with treatment:</b>	Theoretically, if treated early development should be normal. At least one patient went on to develop cardiomyopathy as an adult despite treatment, was found in asystole.
<b><u>Metabolic Information:</u></b>	<b>Missing Enzyme &amp; Location:</b> Sodium ion-dependent carnitine transporter OCTN2- carnitine deficiency from failure of high-affinity carnitine uptake transporters in muscle, heart and kidney that is gradient dependent. There is an inability of the kidneys to conserve carnitine and muscle tissue cannot store carnitine in this disorder. The resulting carnitine deficiency and accumulation of toxic long chain acyl CoA esters impede beta-oxidation and lead to symptoms.
<b>MS/MS profile:</b>	C0 (free carnitine)- very low All carnitine values low
<b>Prenatal testing:</b>	Carnitine uptake studies are possible on amniocytes or CVS.

**Miscellaneous Information:**

Prepared for the NW Regional Newborn Screening Program by Sara Copeland MD, Judith Tuerck RN MS and Lorinda Paradise at OHSU in Portland, OR.

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