Fukuyama Congenital Muscular Dystrophy: FKTN Gene Deletion/Duplication

**Condition Description**

The congenital muscular dystrophies are a group of genetically and clinically heterogeneous hereditary myopathies characterized by congenital hypotonia and muscle weakness, contractures, and delayed motor development. Muscle biopsy usually reveals a nonspecific dystrophic pattern. The clinical course is broadly variable and can involve the brain and eyes. Initial testing often includes clinical evaluation, muscle imaging, electromyography, and muscle biopsy, followed by targeted genetic testing.

Fukuyama congenital muscular dystrophy (FCMD) was first described in 1960 and represents one if the most common autosomal recessive disorders in the Japanese population. FCMD is a severe CMD that is associated with mental retardation. Characteristics include hypotonia, symmetrical generalized muscle weakness, and CNS migration disturbances that result in changes consistent with cobblestone (previously type II) lissencephaly with cerebral and cerebellar cortical dysplasia. Mild, typical, and severe phenotypes are recognized.

Poor fetal movements and birth asphyxia can be the first signs. Onset typically occurs in early infancy, with a poor suck, weak cry, and floppiness. Affected individuals have contractures of the hips, knees, ankles, and elbows with onset before age one year. Later features include myopathic facial appearance; pseudohypertrophy of the calves, forearms, and tongue muscles; severe motor, mental, and speech retardation; convulsions; ophthalmologic abnormalities including myopia, cataracts, optic atrophy, and retinal detachment; and dilated cardiomyopathy and respiratory failure that become symptomatic in the second decade of life. Affected individuals may attain independent sitting but usually do not achieve independent ambulation. Death often occurs by age 20 years.

The clinical manifestations can show a variable degree of severity even among siblings. A few patients can walk without support, have a lesser degree of cognitive deficiency, and may obtain seizure control. The phenotypic spectrum ranges from a Walker-Warburg syndrome (WWS)-like phenotype at the severe end to a limb-girdle muscular dystrophy (LGMD)-like phenotype at the mild end.

Serum creatine kinase (CK) levels in individuals with FCMD are approximately 10-60 times higher than normal in affected children under six years of age, 5-20 times higher than normal after seven years of age, and normal in individuals who are bed-ridden. Muscle biopsy findings are characteristic of muscular dystrophy. Immunohistochemical staining using an alpha-dystroglycan antibody shows selective deficiency of alpha-dystroglycan in skeletal muscle, cardiac muscle, and brain.

Mutation of the FKTN gene (9q31) causes FCMD. A 3kb retrotranspositional insertion into the 3' UTR of the gene constitutes the founder mutation in the Japanese population. Approximately 80% of affected individuals of Japanese ancestry are homozygous for the founder mutation, while an additional 15-20% are compound heterozygotes for the founder mutation and another point mutation. The average occurrence of heterozygous carriers identified in various regions of Japan is one in 188. FCMD is seldom reported outside of Japan.

For patients with suspected FCMD, sequence analysis with Japanese founder mutation analysis is recommended as the first step in mutation identification. For patients in whom mutations are not identified, deletion/duplication analysis is appropriate.

**References**

- Bonnemann, Carsten. Personal communication, July 8, 2009.

**Genes**

**FKTN**

**Indications**

This test is indicated for:

- Confirmation of a clinical diagnosis of Fukuyama CMD in an individual in whom sequence analysis was negative
- Carrier testing in adults with a family history of Fukuyama CMD in whom sequence analysis was negative

**Methodology**

DNA isolated from peripheral blood is hybridized to a CGH array to detect deletions and duplications. The targeted CGH array has overlapping probes which cover the entire genomic region.

Please note that a “backbone” of probes across the entire genome are included on the array for analytical and quality control purposes. Rarely, off-target copy number variants causative of disease may be identified that may or may not be related to the patient's phenotype. Only known pathogenic off-target copy number variants will be reported. Off-target copy number variants of unknown clinical significance will not be reported.

**Detection**
Detection is limited to duplications and deletions. The CGH array will not detect point or intronic mutations.

Results of molecular analysis must be interpreted in the context of the patient’s clinical and/or biochemical phenotype.

**Specimen Requirements**

Submit only 1 of the following specimen types

* Preferred specimen type: Whole Blood

**Type: Whole Blood**

Specimen Requirements:

In EDTA (purple top) tube:
- Infants (2 years): 3-5 ml
- Older Children & Adults: 5-10 ml

Specimen Collection and Shipping: Refrigerate until time of shipment. Ship sample within 5 days of collection at room temperature with overnight delivery.

**Type: Saliva**

Specimen Requirements:

Oragene™ Saliva Collection kit (available through EGL) used according to manufacturer instructions.

Specimen Collection and Shipping: Store sample at room temperature. Ship sample within 5 days of collection at room temperature with overnight delivery.

**Special Instructions**

Submit copies of diagnostic biochemical test results with the sample, if appropriate. Contact the laboratory if further information is needed.

Sequence analysis is required before deletion/duplication analysis by targeted CGH array. If sequencing is performed outside of EGL Genetics, please submit a copy of the sequencing report with the test requisition.

**Related Tests**

- Sequence analysis of the *FKTN* is required before deletion/duplication analysis.
- Prenatal testing is available to couples who are confirmed carriers of mutations. Please contact the laboratory genetic counselor to discuss appropriate testing prior to collecting a prenatal specimen.