Methylmalonic Aciduria and Homocystinuria, cblC Type: *MMACHC* Gene Sequencing

**Test Code:** SMACH  
**Turnaround time:** 4 weeks  
**CPT Codes:** 81479 x1

### Condition Description

Vitamin  
B<sub>12</sub> (cobalamin)  
is a cofactor required by two enzymes, methionine synthase (MTR) and  
methylmalonyl-CoA mutase (MUT). Disorders of intracellular cobalamin metabolism  
may impair the function of either or both enzymes:

- **Clinical syndromes involving**  
defects in MUT function alone are called methylmalonic acidemia. Such defects can be caused by defective MUT enzyme or  
error B<sub>12</sub> cofactor. Certain subtypes of methylmalonic acidemia may  
be further defined by complementation analysis. Complementation groups causing isolated methylmalonic acidemia include cblA and cblB.

- **Clinical syndromes involving**  
defective MTR function can be caused by defective MTR enzyme, missing cofactor,  
or in enzyme that regenerates MTR: methionine synthase reductase (MTRR). Defective MTR function is associated with variable hyperhomocysteinemia  
and/or homocystinuria.

- **Disorders that cause isolated defects in MTR function, as well as disorders that cause combined defects in**  
both MTR and MUT function, are named by complementation group. MTR-only and  
combined MUT/MTR cobalamin disorders include cblC, cblD, cblD variant 1, cblD  
variant 2, cblE, cblF, and cblG.

The  
clinical manifestations of disorders of intracellular cobalamin metabolism,  
identified by complementation class as cblC, cblD, cblD variant 1, cblD variant  
2, cblE, cblF, and cblG, can be highly variable even within a single  
complementation class. cblC is the most common of these disorders. The age of  
initial presentation of cblC ranges from (1) newborns who can be small for  
gestational age (SGA)  
and have microcephaly; to (2) infants who can have poor feeding, failure to  
thrive, pallor, and neurologic signs, and occasionally hemolytic uricemic syndrome (HUS)  
and/or seizures including infantile spasms; to (3) toddlers who  
can have failure to thrive, poor head growth, cytopenias (including megaloblastic  
anemia), global developmental delay, encephalopathy, and neurologic signs such  
as hypotonia and seizures; and to (4) young adults/adults who can have  
confusion, other mental status changes, cognitive decline, and megaloblastic  
anemia.

Metabolic screening tests such as urine organic acid analysis and plasma amino acid analysis help  
categorize the clinical syndrome. Analysis in specialized laboratories can  
establish the specific complementation class. Mutations in the *MMACHC* (1p34.1)  
gene cause cblC. The role of molecular genetic  
testing in diagnosis is evolving; molecular genetic  
testing may be faster and less expensive  
than complementation class analysis in establishing a specific diagnosis in a  
family.

All  
disorders of intracellular cobalamin metabolism are inherited in an autosomal  
recessive manner. Heterozygotes (carriers) are asymptomatic.

[Click here](#) for the GeneTests summary on this condition.

### Genes

*MMACHC*

### Indications

This test is indicated for:

- Confirmation of a clinical/biochemical diagnosis of cblC
- Carrier testing in adults with a family history of cblC
Methodology

PCR amplification of 5 exons contained in the MMACHC gene is performed on the patient's genomic DNA. Direct sequencing of amplification products is performed in both forward and reverse directions, using automated fluorescence dideoxy sequencing methods. The patient's gene sequences are then compared to a normal reference sequence. Sequence variations are classified as mutations, benign variants unrelated to disease, or variations of unknown clinical significance. Variants of unknown clinical significance may require further studies of the patient and/or family members. This assay does not interrogate the promoter region, deep intronic regions, or other regulatory elements, and does not detect large deletions.

Detection

Clinical Sensitivity: Unknown. Mutations in the promoter region, some mutations in the introns and other regulatory element mutations cannot be detected by this analysis. Large deletions will not be detected by this analysis. Results of molecular analysis should be interpreted in the context of the patient's biochemical phenotype.

Analytical Sensitivity: ~99%

Specimen Requirements

Submit only 1 of the following specimen types

* Preferred specimen type: Whole Blood

Type: Whole Blood

Specimen Requirements:

In EDTA (purple top) or ACD (yellow 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.

Related Tests

- Deletion/duplication analysis of the MMACHC gene is also available.
- Custom diagnostic mutation analysis (KM) is available to family members if mutations are identified by targeted mutation testing or sequencing 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.