Glycerol Kinase Deficiency: \textit{GK} Gene Sequencing

\textbf{Test Code:} SGKX1  
\textbf{Turnaround time:} 6 weeks  
\textbf{CPT Codes:} 81479 x1

\section*{Condition Description}

Intellectual disability (ID) is a nonprogressive cognitive impairment affecting 1-3\% of the Western population. It is estimated that up to 50\% of moderate-severe cases have genetic causes and approximately 10\% are due to X-linked intellectual disability disorders (XLID). XLID can be syndromic or nonsyndromic and is observed in all ethnic groups. More than 100 XLID syndromes have been described in the literature to date. Fragile X is the most common XLID syndrome (~1 in 4000 males) while others can be quite rare with only a few patients reported in the literature. Males can have moderate to severe intellectual disability depending on the syndrome, and carrier females can also be affected, but typically have milder clinical symptoms.

Mutations and deletions of the \textit{GK} gene (Xp21.3) cause glycerol kinase deficiency (GKD). GKD can be part of a contiguous gene syndrome or occur as isolated GKD. The isolated form can either be symptomatic or asymptomatic. Isolated symptomatic GKD presents in early childhood with episodes of metabolic (vomiting and acidosis) and central nervous system (CNS) (lethargy and coma) decompensation. Additionally, individuals with the symptomatic GKD were reported to have intellectual disability, developmental delay, and/or seizures. Isolated asymptomatic GKD presents with hyperglycerolemia and glyceroluria but do not have the episodes of metabolic and CNS decompensation.

Complete loss of GK activity, caused by \textit{GK} gene deletions and nonsense mutations, is typically associated with the symptomatic form of GKD. \textit{GK} gene missense mutations that result in residual GK enzyme activity may or may not result in the symptomatic form of GKD.

GKD as part of a contiguous gene syndrome can include the \textit{DAX1} gene, which is responsible for adrenal hypoplasia congenital, the \textit{DMD} gene, which causes Duchenne muscular dystrophy, and/or the \textit{OTC} gene, which is responsible for ornithine transcarbamylase deficiency. The contiguous gene syndrome can be detected by array comparative genomic hybridization (aCGH).

\section*{References:
- OMIM \#300474: \textit{GK} gene
- OMIM \#307030: GKD

\section*{Genes}

\textbf{GK}

\section*{Indications}

This test is indicated for:

\begin{itemize}
  \item Confirmation of a clinical diagnosis of Glycerol Kinase Deficiency.
  \item Carrier testing in adults with a family history of Glycerol Kinase Deficiency.
\end{itemize}

\section*{Methodology}

PCR amplification of 9 exons contained in the \textit{GK} 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.

\section*{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 clinical and/or biochemical phenotype.

Analytical Sensitivity: \~99\%

\section*{Specimen Requirements}

Submit only 1 of the following specimen types

* Preferred specimen type: Whole Blood

\textbf{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.

Related Tests

- Deletion/duplication analysis of the *GK* gene by CGH array is available for those individuals in whom sequence analysis is negative.
- Chromosomal Microarray EmArray60K
- 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 only for known familial mutations to individuals who are confirmed carriers of mutations. Please contact the laboratory genetic counselor to discuss appropriate testing prior to collecting a prenatal specimen.
- X-Linked Intellectual Disability panels are available for 30, 60, and 90 genes.