Autosomal Recessive Polycystic Kidney Disease: \textit{PKHD1} Gene Sequencing

\begin{itemize}
\item \textbf{Test Code:} WF
\item \textbf{Turnaround time:} 6 weeks
\item \textbf{CPT Codes:} 81408 x1
\end{itemize}

\section*{Condition Description}

The majority of individuals with autosomal recessive polycystic kidney disease (ARPKD) present in the neonatal period with enlarged echogenic kidneys. Clinical diagnostic criteria of autosomal recessive polycystic kidney disease (ARPKD) are:

- Typical findings on renal imaging

- One or more of the following:
  \begin{itemize}
  \item Clinical/laboratory signs of hepatic fibrosis that leads to portal hypertension and may be manifested by hepatosplenomegaly and/or esophageal varices
  \item Hepatic pathology demonstrating a developmental ductal plate abnormality
  \item Absence of renal cysts in both parents, as demonstrated by ultrasound examination
  \item Pathoanatomical proof of ARPKD in an affected sib
  \item Parental consanguinity suggesting autosomal recessive inheritance
  \end{itemize}

At initial presentation, approximately 45\% of infants have liver abnormalities, including hepatomegaly, dilated intrahepatic biliary ducts, and increased echogenicity. Pulmonary hypoplasia resulting from oligohydramnios occurs in a number of affected infants. Approximately 30\% of affected neonates die, primarily of respiratory insufficiency. More than 50\% of affected children progress to end-stage renal disease (ESRD), usually in the first decade of life. With neonatal respiratory support and renal replacement therapies, the ten-year survival of those who live beyond the first year of life has improved to 82\%. Fifteen-year survival is estimated to be 67\%-79\%. A minority of individuals present as older children, usually with hepatosplenomegaly as the presenting feature.

\textit{PKHD1} (6p21.1-p12) is the only gene known to be associated with ARPKD. Mutation detection rates for sequence analysis of the coding region and flanking intronic regions have not been reported; they are expected to be as high or higher than those reported for mutation scanning analyses. Mutation scanning by denaturing high-performance liquid chromatography (DHPLC) has demonstrated an overall mutation detection rate of 82\%-85\% when diagnostic criteria of ARPKD are met either prenatally or postnatally.

The incidence of ARPKD is estimated at 1:10,000 to 1:40,000. The true incidence may be underestimated because children may die in the neonatal period without a definitive diagnosis, and previously undetected young adults are being diagnosed by molecular genetic testing. The carrier frequency for a \textit{PKHD1} mutation in the general population is estimated to be 1:70.

For patients with suspected ARPKD, sequence analysis is recommended as the first step in mutation identification. For patients in whom mutations are not identified by full gene sequencing, deletion/duplication analysis is appropriate.

\textit{Click here} for the GeneTests summary on this condition.

\section*{Genes}

\textbf{PKHD1}

\section*{Indications}

This test is indicated for:

- Confirmation of a clinical diagnosis of ARPKD
- Carrier testing in adults with a family history of ARPKD

\section*{Methodology}

\textbf{Next Generation Sequencing:} In-solution hybridization of all coding exons is performed on the patient's genomic DNA. Although some deep intronic regions may also be analyzed, this assay is not meant to interrogate most promoter regions, deep intronic regions, or other regulatory elements, and does not detect single or multi-exon deletions or duplications. Direct sequencing of the captured regions is performed using next generation sequencing. The patient's gene sequences are then compared to a standard reference sequence. Potentially causative variants and areas of low coverage are Sanger-sequenced. Sequence variations are classified as pathogenic, likely pathogenic, benign, likely benign, or variants of unknown significance. Variants of unknown significance may require further studies of the patient and/or family members.

\section*{Detection}

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Clinical Sensitivity: Approximately 85% or higher when diagnostic criteria of ARPKD are met either prenatally or postnatally. 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) 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**

- Deletion/duplication analysis of the *PKHD1* gene by CGH array is available for those individuals in whom sequence analysis is negative (WG).
- *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.