MAYO CLINIC LABORATORIES

Test Definition: PKC

PK Enzyme Activity, B

Overview

Useful For

Evaluation of nonspherocytic hemolytic anemia
Evaluation of neonatal anemia or jaundice
Evaluation of unexplained non-infectious hepatic failure
Evaluation of unexplained iron overload
Evaluation of unusually severe hemoglobin S trait
Evaluation of unusually severe glucose-6-phosphate dehydrogenase deficiency
Investigating families with pyruvate kinase deficiency to determine inheritance pattern and for genetic counseling

Method Name

Only available as part of a profile. For more information see:
HAEV1 / Hemolytic Anemia Evaluation, Blood
EEEV1 / Red Blood Cell (RBC) Enzyme Evaluation, Blood
Kinetic Spectrophotometry (KS)

NY State Available

Yes

Specimen

Specimen Type

Whole Blood ACD-B

Specimen Required

Only available as part of a profile. For more information see:
HAEV1 / Hemolytic Anemia Evaluation, Blood
EEEV1 / Red Blood Cell (RBC) Enzyme Evaluation, Blood

Reject Due To

Gross hemolysis	Reject

Specimen Minimum Volume

1 mL

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole Blood ACD-B	Refrigerated (preferred)	20 days	

Clinical & Interpretive

Clinical Information

Deficiencies of most of the enzymes of the Embden-Meyerhof (glycolytic) pathway, including pyruvate kinase (PK), have been reported. PK deficiency (OMIM 266200), is the erythrocyte enzyme deficiency most frequently found to be a cause of chronic nonspherocytic hemolytic anemia (CNSHA). It is an autosomal recessive disorder and parents of affected patients are typically carriers. Some PK carrier states can exacerbate other red blood cell disorders (ie, coincident glucose 6-phosphate dehydrogenase deficiency or hemoglobin S trait).

Clinically significant PK deficiency manifests in widely variable severity ranging from incidental compensated mild normocytic anemia to severe anemia. Neonatal jaundice is very common, and a significant subset of neonates has perinatal complications. Other symptoms include early gallstones and splenomegaly. Iron overload, even in the absence of frequent transfusions, is very common. Rare severe PK deficiency is associated with hydrops fetalis/fetal demise or unexplained non-infectious hepatic failure. Acquired PK deficiency can arise secondary to myeloid neoplasms.

Reference Values

Only available as part of a profile. For more information see:

HAEV1 / Hemolytic Anemia Evaluation, Blood

EEEV1 / Red Blood Cell (RBC) Enzyme Evaluation, Blood

> or =12 months of age: 5.5-12.4 U/g Hb

Reference values have not been established for patients who are less than12 months of age.

Interpretation

Pyruvate kinase (PK) deficiency is the most easily masked of the red blood cell (RBC) enzyme disorders and can be difficult to classify without complete information, which may require comparison to other RBC enzyme activity levels and/or correlation with results of *PKLR* gene molecular testing (PKLRG / Pyruvate Kinase Liver and Red Blood Cell (*PKLR*), Full Gene Sequencing and Large Deletion Detection, Varies). Most hemolytic anemias due to PK deficiency are associated with activity levels less than 40% of mean normal. However, some patients with clinically significant hemolysis can have normal or only mildly decreased PK enzyme activity, which, paradoxically, may occur in individuals with the most severe symptoms. Isolated carriers (heterozygotes) may show mildly decreased activity and are typically hematologically normal, although the carrier state may exacerbate other RBC disorders such as glucose 6-phosphate dehydrogenase (G6PD), deficiency, RBC membrane disorders or hemoglobinopathies. Some alterations in other genes (ie, *KLF1*) can be associated with decreased PK levels.

Elevated PK concentrations can be found in those patients with younger erythrocyte population. This may be due to the patient being a newborn or young red cells are being produced in response to the anemia (reticulocytosis). Rare PK deficient cases have been associated with minimally increased PK levels; however, comparison to other RBC enzyme activity would be critical in these cases for accurate interpretation.

Cautions

Pyruvate kinase (PK) activity level can vary from markedly decreased to normal levels in affected individuals due to a compensated increase in enzyme by reticulocytes. Comparison of PK activity levels to other RBC enzyme activity can be very useful.

Recent transfusion may mask the patient’s intrinsic enzyme activity and cause unreliable results.

Because leukocytes also contain PK if the white blood cell (WBC) count is very high, false-negative results may occur due to inability to adequately remove WBCs from the assay.

Clinical Reference

1. Grace RF, Bianchi P, van Beers EJ, et al. The clinical spectrum of pyruvate kinase deficiency: data from the Pyruvate Kinase Deficiency Natural History Study. Blood. 2018 May 17;131(20):2183-2192

2. Gallagher PG, Glader B. Diagnosis of pyruvate kinase deficiency. Pediatr Blood Cancer. 2016 May;63(5):771-772

3. Grace RF, Zanella A, Neufeld EJ, et al: Erythrocyte pyruvate kinase deficiency: 2015 status report. Am J Hematol. 2015 Sep;90(9):825-830

4. Zanella A, Fermo E, Bianchi P, Chiarelli LR, Valentini G: Pyruvate kinase deficiency: the genotype-phenotype association. Blood Rev. 2007 Jul;21(4):217-231

Performance

Method Description

Pyruvate kinase catalyzes the phosphorylation of adenine diphosphate to adenine triphosphate by converting phosphoenolpyruvate to pyruvate. The amount of pyruvate formed is quantitated by adding lactate dehydrogenase and reduced nicotinamide adenine dinucleotide (NADH) and measuring the rate of decrease in absorbance spectrophotometrically at 340 nm as the NADH is oxidized to NAD(+) on an automated chemistry analyzer.(Beutler E: Red Cell Metabolism. In: A Manual of Biochemical Methods. 3rd ed. Grune and Stratton; 1984:68-71; van Solinge WW, van Wijk: Enzymes of the red blood cell. In: Rifai N, Horvath AR, Wittwer CT: eds. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 6th ed. Elsevier; 2018:chap 30)

PDF Report

No

Specimen Retention Time

28 days

Performing Laboratory Location

Rochester

Fees & Codes

Test Classification

This test was developed, and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

84220