Test Definition: HPFH

Hemoglobin F Distribution, Blood
(Non-Orderable)

Overview

Useful For

Only orderable as a reflex. For more information see:
HAEV1 / Hemolytic Anemia Evaluation, Blood
HBEL1 / Hemoglobin Electrophoresis Evaluation, Blood
MEV1 / Methemoglobinemia Evaluation, Blood
REVE2 / Erythrocytosis Evaluation, Blood
THEV1 / Thalassemia and Hemoglobinopathy Evaluation, Blood and Serum

Distinguishing large deletional hereditary persistence of fetal hemoglobin from other conditions with increased percentage of fetal hemoglobin (HbF)

Determining the distribution of HbF within red blood cells

Method Name

Only orderable as a reflex. For more information see:
-HAEV1 / Hemolytic Anemia Evaluation, Blood
-HBEL1 / Hemoglobin Electrophoresis Evaluation, Blood
-MEV1 / Methemoglobinemia Evaluation, Blood
-REVE2 / Erythrocytosis Evaluation, Blood
-THEV1 / Thalassemia and Hemoglobinopathy Evaluation, Blood and Serum

Flow Cytometry

NY State Available

Yes

Specimen

Specimen Type

Whole Blood EDTA

Ordering Guidance

This test is for hereditary persistence of fetal hemoglobin only. For testing for possible fetal-maternal bleed, see FMB / Fetomaternal Bleed, Flow Cytometry, Blood.

Specimen Required

Only orderable as a reflex. For more information see:
-HAEV1 / Hemolytic Anemia Evaluation, Blood

-HBEL1 / Hemoglobin Electrophoresis Evaluation, Blood
-MEV1 / Methemoglobinemia Evaluation, Blood
-REVE2 / Erythrocytosis Evaluation, Blood
-THEV1 / Thalassemia and Hemoglobinopathy Evaluation, Blood and Serum

Specimen Minimum Volume
0.5 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Clotted blood	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole Blood EDTA	Refrigerated	14 days	

Clinical & Interpretive

Clinical Information
More than 75% of the hemoglobin in a newborn infant is fetal hemoglobin (HbF); it diminishes over a period of several months to adult levels, reducing to less than 2% by 1 year of age and less than 1% by 2 years of age.

Hemoglobin F may constitute 90% of the total Hb in patients with beta-thalassemia major or other combinations of beta thalassemia and fetal Hb (hereditary persistence of fetal hemoglobin: HPFH) variants.

Hemoglobin F is often mildly to moderately elevated in sickle cell disease, aplastic anemia, acute leukemia, and myeloproliferative disorders, such as juvenile myelomonocytic leukemia, hereditary spherocytosis, and alpha-thalassemia minor. It is commonly increased in hemoglobinopathies associated with hemolysis. HbF increases to as high as 10% during normal pregnancy. HbF is also increased due to medications such as hydroxyurea, decitabine, and lenalidomide. Elevation in HbF has a been cited as a discriminator between Diamond-Blackfan congenital pure red cell aplasia (elevated) and transient erythroblastopenia of childhood (normal), but whether this simply reflects the chronicity of anemia inherent to the former condition rather than a specific finding is unclear.

In the common (large deletional) form of the genetic trait HPFH, all erythrocytes contain HbF. When tested by flow cytometry using specificity for HbF, these HPFH cases display a homocellular distribution pattern of HbF within the red blood cell population. Other causes of increased HbF, including delta beta thalassemia, hydroxyurea, and some nondeletional HPFH variants, typically display a heterocellular distribution of HbF within the erythrocytes, reflecting disparate populations of F cells and cells lacking HbF. Quantification of HbF percentage should be determined prior to flow cytometry of HbF red blood cell distribution to establish the appropriateness of this test. The flow cytometry

analysis of elevated HbF levels is useful when HbF percentage is 15% to 35% and the clinical differential diagnosis includes large deletional HPFH. HbF percentages below 15% are likely not due to large deletional HPFH, and the causes of HbF percentages above 35% are better confirmed by molecular and family studies.

Reference Values

Only orderable as a reflex. For more information see:
-HAEV1 / Hemolytic Anemia Evaluation, Blood
-HBEL1 / Hemoglobin Electrophoresis Evaluation, Blood
-MEV1 / Methemoglobinemia Evaluation, Blood
-REVE2 / Erythrocytosis Evaluation, Blood
-THEV1 / Thalassemia and Hemoglobinopathy Evaluation, Blood and Serum

Reported as: Heterocellular, Homocellular, or Equivocal

Interpretation

Homocellular distribution of fetal hemoglobin (HbF) is found in large deletional hereditary persistence of HbF.

Heterocellular distribution is found in delta beta thalassemia, medication induced, and other causes of increased HbF.

An equivocal result indicates the pattern is not typical for either a homocellular or heterocellular distribution.

Cautions

When hemoglobin F values are above 35%, most specimens show a homocellular pattern; this does not necessarily indicate hereditary persistence of fetal hemoglobin. Clinical correlation is needed.

Clinical Reference

1. Kleihauer E, Braun H, Betke K. Demonstration von fetalem Hamoglobin in den Erythrocyten eines Blutaustrichs. Klin Wschr. 1957;35(12):637-638
2. Shepard MK, Weatherall DJ, Conley CC. Semi-quantitative estimation of the distribution of fetal hemoglobin in red cell populations. Bull Johns Hopkins Hospital. 1962;110:293-310
3. Davis BH, Olsen S, Bigelow NC, Chen JC. Detection of fetal red cells in fetomaternal hemorrhage using a fetal hemoglobin monoclonal antibody by flow cytometry. Transfusion. 1998;38(8):749-756
4. Hoyer JD, Penz CS, Fairbanks VF, et al. Flow cytometric measurement of hemoglobin F in RBCs: diagnostic usefulness in the distinction of hereditary persistence of fetal hemoglobin (HPFH) and hemoglobin S-hPFH from other conditions with elevated levels of hemoglobin F. Am J Clin Pathol. 2002;117(6):857-863
5. Stephens AD, Angastiniotis M, Baysal E, et al. International Council for The Standardisation of Haematology (ICSH). ICSH recommendations for the measurement of haemoglobin F. Int J Lab Hematol. 2012;34(1):14-20
6. Khandros E, Blobel GA. Heterogeneity of fetal hemoglobin production in adult red blood cells. Curr Opin Hematol. 2021;28(3):164-170

Performance

Method Description

This assay uses a flow cytometric method with a monoclonal antibody to fetal hemoglobin (HbF). Specimens are analyzed by single-color flow cytometry using fluorescein anti-HbF. In normal adults, a single peak is seen with minimal fluorescence, which corresponds to HbA. In neonates, a single peak with bright fluorescence is seen, which corresponds to HbF. In cases of hereditary persistence of fetal Hb (HPFH) only, a single peak is observed, which has a fluorescence intensity intermediate between the normal HbA and HbF peaks. This pattern corresponds to the homocellular (pancellular) pattern obtained by the Kleihauer-Betke (K-B) method. In contrast, specimens from infants, transfused neonates, and cases of beta thalassemia or delta/beta thalassemia show both HbA and HbF peaks, corresponding to the heterocellular pattern of the K-B method. In patients with HbS/HPFH, a single peak was observed in contrast to patients with homozygous S in which 2 peaks were observed.(Package insert: Invitrogen Fetal Hemoglobin Test Kit with FITC-conjugated Monoclonal Antibody Directed to HbF. Life Technologies Corporation; MAN 0003641, Rev 3.02, 11/21/2019)

PDF Report
No

Day(s) Performed
Monday through Friday

Report Available
3 to 5 days

Specimen Retention Time
1 week

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

Fees & Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification
This test has been modified from the manufacturer's instructions. Its performance characteristics were 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
88184

LOINC® Information

MAYO CLINIC LABORATORIES

Test Definition: HPFH

Hemoglobin F Distribution, Blood
(Non-Orderable)

Test ID	Test Order Name	Order LOINC® Value
HPFH	Hb F Distribution, B	4579-9

Result ID	Test Result Name	Result LOINC® Value
8270	Hb F Distribution, B	4579-9
2104	Interpretation	59466-3