MAYO CLINIC LABORATORIES

Test Definition: HGBCE

Hemoglobin Variant, A2 and F Quantitation, Blood

Overview

Useful For

Monitoring patients with sickling disorders who have received hydroxyurea or transfusion therapy

This test is **not intended for** diagnostic purposes.

This test is **not useful for** screening purposes.

Special Instructions

- Metabolic Hematology Patient Information
- Benign Hematology Evaluation Comparison

Method Name

Capillary Electrophoresis

NY State Available

Yes

Specimen

Specimen Type

Whole Blood EDTA

Ordering Guidance

This test is intended for monitoring purposes, such as the increase in hemoglobin F after therapy or the levels of hemoglobin variants after transfusion.

If the patient has never been appropriately studied, hemoglobin electrophoresis is necessary; see HBEL1 / Hemoglobin Electrophoresis Evaluation, Blood.

Multiple hematology evaluations are available. For information on testing that is performed with each evaluation, see Benign Hematology Evaluation Comparison.

Specimen Required

Container/Tube:
Preferred: Lavender top (EDTA)
Acceptable: Yellow top (ACD)
Specimen Volume: 4 mL
Collection Instructions:

1. Submit fresh specimen.
2. Send whole blood specimen in original tube. **Do not aliquot**.

Forms
1. Metabolic Hematology Patient Information (T810)
2. If not ordering electronically, complete, print, and send a Benign Hematology Test Request Form (T755) with the specimen.

Specimen Minimum Volume
1 mL

Reject Due To

Gross hemolysis	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Whole Blood EDTA	Refrigerated	10 days	

Clinical & Interpretive

Clinical Information
The treatment of red blood cell sickling disorders may involve many therapeutic modalities. Two of the most important and beneficial are treatment with hydroxyurea and chronic transfusion therapy. Hydroxyurea causes elevation of fetal hemoglobin (HbF) levels, and transfusion serves to lower the percentage of hemoglobin S (HbS). Both of these therapeutic modalities act to lessen the number and severity of sickling crises. Thus, periodic monitoring of HbF and HbS levels are needed to guide further therapy.

Reference Values
HEMOGLOBIN A
0-30 days: 5.9-77.2%
1-2 months: 7.9-92.4%
3-5 months: 54.7-97.1%
6-8 months: 80.0-98.0%
9-12 months: 86.2-98.0%
13-17 months: 88.8-98.0%
18-23 months: 90.4-98.0%
> or =24 months: 95.8-98.0%

HEMOGLOBIN A2
0-30 days: 0.0-2.1%

1-2 months: 0.0-2.6%
3-5 months: 1.3-3.1%
> or =6 months: 2.0-3.3%

HEMOGLOBIN F
0-30 days: 22.8-92.0%
1-2 months: 7.6-89.8%
3-5 months: 1.6-42.2%
6-8 months: 0.0-16.7%
9-12 months: 0.0-10.5%
13-17 months: 0.0-7.9%
18-23 months: 0.0-6.3%
> or =24 months: 0.0-0.9%

VARIANT 1
0.0

VARIANT 2
0.0

VARIANT 3
0.0

Interpretation

Clinically, optimal levels of hemoglobin (Hb) S and fetal hemoglobin (HbF) are patient specific and depend on a number of factors including response to therapy. This test will be performed by capillary electrophoresis, and any detected variant present will be reported as their zone only, including HbS. No confirmatory functional study, such as sickle solubility, will be performed as this test is designed for quantitative monitoring of previously confirmed hemoglobin fractions.

Information reported: Percentages of HbA, HbA2, HbF and any detected hemoglobin variant present. Variants will be reported as zones and are not specific, even if present in Z5 (Zone S). If the identity of the variant has not been previously confirmed, diagnostic hemoglobin electrophoresis testing is necessary; see HBEL1 / Hemoglobin Electrophoresis Evaluation, Blood.

Cautions

Peaks present in zones Z9, Z7, Z6, Z5, Z4, Z3, and Z2-recently labeled the Z(A), Z(F), Z(D), Z(S), Z(E), Z(A2), and Z(C) zones, respectively-may not represent the hemoglobin fractions the zones are named after as other variants can migrate to these zones, including the S, F, A, and A2 positions.

Although the most common variants are easily detected, many hemoglobin variants are not detected by the capillary electrophoresis method alone or can migrate with, and cannot be discriminated from, common variants. Therefore, this test should not be used for screening purposes due to low sensitivity.

Recent transfusion may mask protein results including hemoglobin electrophoresis, hereditary persistence of fetal hemoglobin by flow cytometry, stability studies, and sickle solubility studies depending on percentage of transfused cells present.

Some hemoglobin variants can originate from the donor blood product and not from the tested recipient. These are typically found in low percentages.

Some hemoglobin variants do not sufficiently resolve from other peaks, which precludes separate quantitation of percentages. These will be reported as a single percentage that represents more than one variant.

Some therapies cause artefactual effects in protein studies, including voxelotor (artefactual peaks). These peaks may vary between samples or patients.

Clinical Reference

1. Riou J, Szuberski J, Godart C, et al. Precision of CAPILLARYS 2 for the detection of hemoglobin variants based on their migration positions. Am J Clin Pathol. 2018;149(2):172-180
2. National Heart, Lung, and Body Institute Expert Panel: Evidence-Based Management of Sickle Cell Disease: Expert Panel Report, 2014. NIH Publication No. 02-2117 US Department of Health and Human Services: National Institutes of Health; 2014:1-142
3. Andrews J, Marques MB. Transfusion Support for Patients with Sickle Cell Disease. AABB; 2022
4. Ferster A, Tahriri P, Vermylen C, et al. Five years of experience with hydroxyurea in children and young adults with sickle cell disease. Blood. 2001;97:3268-3632
5. Charache S, Terrin ML, Moore RD, et al. Effect of hydroxyurea on the frequency of painful crises in sickle cell anemia. Investigators of the Multicenter Study of Hydroxyurea in Sickle Cell Anemia. N Engl J Med. 1995;332(20):1317-1322
6. Keren DF, Shalhoub R, Gulbranson R, Hedstrom D. Expression of hemoglobin variant migration by capillary electrophoresis relative to hemoglobin A2 improves precision. Am J Clin Pathol. 2012;137(4):660-664
7. Olivieri M, Rosetti M, Poletti G, et al. Ability of the capillary electrophoresis-based HbA1c assay to detect rare hemoglobin variants. Ann Lab Med. 2024;45(1):101-104

Performance

Method Description

The CAPILLARYS System is an automated system that uses capillary electrophoresis to separate charged molecules by their electrophoretic mobility in an alkaline buffer. Separation occurs according to the electrolyte pH and electro-osmotic flow. A sample dilution with hemolyzing solution is injected by aspiration. A high-voltage protein separation occurs with direct detection of the hemoglobin protein fractions at 415 nm, which is specific to hemoglobins. The resulting electropherogram peaks are evaluated for pattern abnormalities and are quantified as a percentage of the total hemoglobin present. For diagnostic purposes, the overall schematic has been grouped into 15 unequal zones (Z) numbered from right to left with zones Z9, Z7, Z6, Z5, Z4, Z3 and Z2-relabeled as Z(A), Z(F), Z(D), Z(S), Z(E), Z(A2) and Z(C) zones, respectively. Hemoglobin A (Hb A) and Hb A2 are used as internal standards and are assigned the numerical positions 150 and 243, respectively.(Louahabi A, Philippe M, Lali S, Wallemacq P, Maisin D. Evaluation of a new Sebia kit for analysis of hemoglobin fractions and variants on the Capillarys system. Clin Chem Lab Med. 2006;44[3]:340-345;

instruction manual: CAPI 3 HEMOGLOBIN(E) Phoresis VS ≥9.15. Sebia; 12/2020)

PDF Report
No

Day(s) Performed
Monday through Friday

Report Available
Same day/1 to 2 days

Specimen Retention Time
7 days

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
83020

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
HGBCE	Hb Variant, A2 and F Quantitation,B	43113-0

Result ID	Test Result Name	Result LOINC® Value
41927	Hb A	20572-4
41928	Hb F	32682-7
41929	Hb A2	4552-6
41930	Variant 1	24469-9
41931	Variant 2	24469-9

41932	Variant 3	24469-9
41933	HGBCE Interpretation	78748-1