MAYO CLINIC LABORATORIES

Test Definition: COGBM

Chromosome Analysis, Hematologic Disorders, Children's Oncology Group Enrollment Testing, Bone Marrow

Overview

Useful For

Evaluation of pediatric bone marrow specimens for chromosomal abnormalities associated with hematologic malignancies for diagnostic and prognostic purposes in patients being considered for enrollment in Children's Oncology Group clinical trials and research protocols using bone marrow specimens

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
ML20C	COG Metaphases, 1-19	No, (Bill Only)	No
M25C	COG Metaphases, 20-25	No, (Bill Only)	No
MG25C	COG Metaphases, >25	No, (Bill Only)	No
_STAC	Ag-Nor/CBL Stain	No, (Bill Only)	No

Testing Algorithm

This test includes a charge for cell culture of fresh specimens and professional interpretation of results. Analysis charges will be incurred for total work performed, and generally include 2 banded karyograms and the analysis of 20 metaphase cells. If no metaphase cells are available for analysis, no analysis charges will be incurred. If additional analysis work is required, additional charges may be incurred.

If this test is ordered and the laboratory is informed that the patient is not on a Children's Oncology Group (COG) protocol, this test will be canceled and automatically reordered by the laboratory as the corollary assay, CHRBM / Chromosome Analysis, Hematologic Disorders, Bone Marrow.

For more information see:
-Multiple Myeloma: Laboratory Screening
-Myeloproliferative Neoplasm: A Diagnostic Approach to Bone Marrow Evaluation
-Acute Promyelocytic Leukemia: Guideline to Diagnosis and Follow-up
-B-Lymphoblastic Leukemia/Lymphoma Algorithm

Special Instructions

- Multiple Myeloma: Laboratory Screening
- Myeloproliferative Neoplasm: A Diagnostic Approach to Bone Marrow Evaluation
- Acute Promyelocytic Leukemia: Guideline to Diagnosis and Follow-up
- B-Lymphoblastic Leukemia/Lymphoma Algorithm

Highlights

Cytogenetic testing is important for the diagnostic and prognostic classification of pediatric neoplasia and it is a critical element for the enrollment of children into clinical trials affiliated with the Children's Oncology Group (COG). For over 25

years the Mayo Clinic Genomics Laboratory has served as one of a select number of laboratories in the United States approved by the COG for the conventional chromosome analysis and fluorescence in situ hybridization (FISH) analysis of pediatric bone marrow, peripheral blood, and tissue specimens. All enrollment-required elements of cytogenetic testing will be electronically submitted by the Mayo Clinic Genomics Laboratory within the guidelines of COG.

Method Name
Cell Culture without Mitogens followed by Chromosome Analysis

NY State Available
Yes

Specimen

Specimen Type
Bone Marrow

Ordering Guidance
This test is only performed on specimens from pediatric patients being considered for enrollment in a Children's Oncology Group (COG) protocol. For all other patients, order CHRBM / Chromosome Analysis, Hematologic Disorders, Bone Marrow.

Shipping Instructions
Advise Express Mail or equivalent if not on courier service.

Necessary Information
1. A reason for referral, a flow cytometry and/or a bone marrow pathology report, and a Children's Oncology Group (COG) registration number and protocol number should be submitted with each specimen. The laboratory will not reject testing if this information is not provided, but appropriate testing and interpretation may be compromised or delayed.
2. If a child enrolled in the COG protocol has received an opposite sex bone marrow transplant prior to specimen collection, note this information on the request.
3. To ensure the best interpretation, it is important to provide some clinical information to verify the appropriate type of cytogenetic study is performed.

Specimen Required
Specimen Type: Bone marrow
Container/Tube:
Preferred: Yellow top (ACD)
Acceptable: Green top (sodium heparin) or lavender top (EDTA)
Specimen Volume: 4 mL
Collection Instructions:
1. It is preferable to send the first aspirate from the bone marrow collection.

2. Invert several times to mix bone marrow.

Forms

If not ordering electronically, complete, print, and send a Children's Oncology Group Test Request (T829) with the specimen.

Specimen Minimum Volume

2 mL

Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Bone Marrow	Ambient (preferred)		
	Refrigerated		

Clinical & Interpretive

Clinical Information

Clonal chromosome abnormalities in bone marrow (or peripheral blood or tissue if bone marrow is not available) play a central role in the pathogenesis, diagnosis, and treatment monitoring of pediatric hematologic malignancies.

Characteristic chromosome rearrangements and copy number patterns may help classify a pediatric hematologic malignancy. For example, t(1;19)(q23;p13.3) is typically observed in B-cell acute lymphoblastic leukemia/lymphoma and t(8;21)(q22;q22) defines a specific subset of patients with acute myeloid leukemia; while t(7;14)(q35;q11.2) is associated with T-lymphoblastic leukemia/lymphoma. Confirmation of classic gene fusions associated with the above translocations together with evaluation for other recurrent abnormalities are available within the appropriate Children's Oncology Group (COG) fluorescence in situ hybridization (FISH) panels; COGBF / B-Cell Acute Lymphoblastic Leukemia/Lymphoma (ALL), Children's Oncology Group Enrollment Testing, FISH, Varies; COGTF / T-Cell Acute Lymphoblastic Leukemia/Lymphoma (ALL), Children's Oncology Group Enrollment Testing, FISH, Varies; and COGMF / Acute Myeloid Leukemia (AML), Children's Oncology Group Enrollment Testing, FISH, Varies. Some rearrangements identified by chromosomal analysis may be extremely rare but are known recurrent entities for which the Mayo Clinic Genomics Laboratory has the most extensive catalogue of FISH testing to confirm the corollary gene fusions.

Metaphase FISH confirmation of classic translocations that are cryptic and not visually detectable by chromosome analysis [ie, t(12;21) associated with *ETV6/RUNX1* fusion] is performed as required by COG and is included as part of the electronic case submission by the Mayo Clinic Genomics Laboratory to COG for central review.

Additional cytogenetic techniques such as chromosomal microarray (CMAH / Chromosomal Microarray, Hematologic Disorders, Varies) may be helpful to resolve questions related to ploidy (hyperdiploid clone vs doubled hypodiploid

clone) or to resolve certain clonal structural rearrangements such as the presence or absence of intra-chromosomal amplification of chromosome 21 (iAMP21). If the expert cytogeneticist at Mayo Clinic reviewing this test's case feels microarray assay may be of benefit, the client will be contacted. For children in whom disease relapse or a secondary myeloid neoplasm is a concern and enrollment in a new COG protocol is being considered; this test is appropriate for bone marrow chromosome analysis.

Reference Values

An interpretative report will be provided.

Interpretation

The following factors are important when interpreting the results:
-Although the presence of an abnormal clone usually indicates a malignant neoplastic process, in rare situations, the clone may reflect a benign condition.
-The absence of an abnormal clone may be the result of specimen collection from a site that is not involved in the neoplasm or may indicate that the disorder is caused by submicroscopic abnormalities that cannot be identified by chromosome analysis.
-On rare occasions, the presence of an abnormality may be associated with a constitutional abnormality that is not related to a malignant neoplastic process. Follow-up with a medical genetics consultation is recommended.
-On occasion, bone marrow chromosome studies are unsuccessful. If clinical information has been provided, we may have a fluorescence in situ hybridization study option that could be performed.

Cautions

In some cases, fluorescence in situ hybridization studies may detect some disorders better than conventional chromosome studies.

Interfering factors:
Technical:
-Insufficient bone marrow specimen
-Use of an improper anticoagulant or improperly mixing the blood with the anticoagulant
-Clotted bone marrow specimen
-Excessive transport time
-Exposure of the specimen to extreme temperature
-Not processing the bone marrow as indicated before shipping the specimen
-Not sending the first aspirate from the patient's bone marrow collection

Biological:
-Abnormalities missed due to sampling error
-Subtle structural chromosome abnormalities may not be detected by conventional chromosome analysis
-Neoplastic cells not dividing or not present in bone marrow

Clinical Reference

1. Dewald GW, Ketterling RP, Wyatt WA, Stupca PJ. Cytogenetic studies in neoplastic hematologic disorders. In: McClatchey KD, ed. Clinical Laboratory Medicine. 2nd ed. Williams and Wilkens; 2002:658-685
2. De Haas V, Ismaila N, Advani A, et al. Initial diagnostic work-up of acute leukemia: ASCO Clinical Practice Guideline

Endorsement of the College of American Pathologists and American Society of Hematology Guideline. J Clin Oncol. 2019;37(3):239-253

3. Swerdlow SH, Campo E, Harris NL, et al, eds. WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues. IARC Press; 2017

4. Arber DA, Borowitz MJ, Cessna M, et al. Initial diagnostic workup of acute leukemia: Guideline from the College of American Pathologists and the American Society of Hematology. Arch Pathol Lab Med. 2017;141(10):1342-1393

Performance

Method Description

The test is only performed on specimens from pediatric patients being considered for enrollment in a Children's Oncology Group protocol. A cell count is performed on the specimen to establish a plating volume. Based on the cell count, a corresponding volume of bone marrow is added to 2 culture flasks containing culture medium and incubated for 24 to 48 hours at 37 degrees C. In the harvest process, the cells are exposed to Colcemid and hypotonic solution, and are fixed with glacial acid and methanol. Metaphase cells are dropped onto microscope slides and are stained by G-banding. Other staining methods are employed as needed. Twenty metaphases are usually examined. If a clone is suspected, but not confirmed within 20 metaphases, 30 metaphases will be analyzed. Minimal evidence for the presence of an abnormal clone is defined as 2 or more metaphases with the same structural abnormality or chromosome gain (trisomy), or 3 or more metaphases lacking the same chromosome. All metaphases are captured using a computerized imaging system, and 1 or more karyograms from each clone are prepared to document the type of abnormality and to permit systematic interpretation of the abnormalities.(Arsham, Marilyn S., et al. eds. The AGT Cytogenetics Laboratory Manual. 4th ed. Wiley-Blackwell, 2017)

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available

9 to 11 days

Specimen Retention Time

4 weeks

Performing Laboratory Location

Rochester

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

CPT Code Information

88237, 88291-Tissue culture for neoplastic disorders; bone marrow, blood, Interpretation and report
88264 w/ modifier 52-Chromosome analysis with less than 20 cells (if appropriate)
88264-Chromosome analysis with 20 to 25 cells (if appropriate)
88264, 88285-Chromosome analysis with greater than 25 cells (if appropriate)
88283-Additional specialized banding technique (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
COGBM	COG-Chromosomes, Hematologic, BM	62386-8

Result ID	Test Result Name	Result LOINC® Value
602306	Result Summary	50397-9
602307	Interpretation	69965-2
602308	Result	62356-1
GC022	Reason for Referral	42349-1
602309	Specimen	31208-2
602310	Source	31208-2
602311	Method	85069-3
602312	Banding Method	62359-5
602313	Additional Information	48767-8
602314	Released By	18771-6