Overview

Useful For
Assisting in the diagnosis and classification of certain malignant hematological disorders
Evaluating the prognosis in patients with certain malignant hematologic disorders
Monitoring effects of treatment
Monitoring patients in remission

Reflex Tests

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Reporting Name</th>
<th>Available Separately</th>
<th>Always Performed</th>
</tr>
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<tbody>
<tr>
<td>ML20</td>
<td>Metaphases, 1-19</td>
<td>No, (Bill Only)</td>
<td>No</td>
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<td>M25</td>
<td>Metaphases, 20-25</td>
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<td>MG25</td>
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<td>STAC</td>
<td>Ag-Nor/CBL Stain</td>
<td>No, (Bill Only)</td>
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</tbody>
</table>

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.

In addition to the cell culture without mitogens, a CpG-stimulated culture will be added and 10 additional cells will be analyzed for any specimen received from a patient age 30 or older with a reason for testing of chronic lymphocytic leukemia, small lymphocytic leukemia, lymphocytosis, Waldenstrom macroglobulinemia, or when test CLLF / Chronic Lymphocytic Leukemia (CLL), FISH is ordered concurrently.

The following algorithms are available in Special Instructions:

- Acute Myeloid Leukemia: Testing Algorithm
- Acute Myeloid Leukemia: Relapsed with Previous Remission Testing Algorithm
- Acute Promyelocytic Leukemia: Guideline to Diagnosis and Follow-up
- B-Lymphoblastic Leukemia/Lymphoma Algorithm
- Bone Marrow Staging for Known or Suspected Malignant Lymphoma Algorithm
- Laboratory Screening Tests for Suspected Multiple Myeloma
- Myelodysplastic Syndrome: Guideline to Diagnosis and Follow-up
- Myeloproliferative Neoplasm: A Diagnostic Approach to Bone Marrow Evaluation
If this test is ordered and the laboratory is informed that the patient is on a Children's Oncology Group (COG) protocol, this test will be canceled and automatically reordered by the laboratory as COGBM / Chromosome Analysis, Hematologic Disorders, Children's Oncology Group Enrollment Testing, Bone Marrow.

**Special Instructions**
- Laboratory Screening Tests for Suspected Multiple Myeloma
- Myeloproliferative Neoplasm: A Diagnostic Approach to Bone Marrow Evaluation
- Bone Marrow Staging for Known or Suspected Malignant Lymphoma Algorithm
- Myelodysplastic Syndrome: Guideline to Diagnosis and Follow-up
- Acute Promyelocytic Leukemia: Guideline to Diagnosis and Follow-up
- B-Lymphoblastic Leukemia/Lymphoma Algorithm
- Acute Myeloid Leukemia: Testing Algorithm
- Acute Myeloid Leukemia: Relapsed with Previous Remission Testing Algorithm

**Method Name**
Cell Culture without Mitogens followed by Chromosome Analysis

**NY State Available**
Yes

**Specimen**

**Specimen Type**
Bone Marrow

**Advisory Information**
When this test and PCPDS / Plasma Cell Proliferative Disorder, FISH, Bone Marrow are ordered together and there is insufficient specimen for both tests, this test will be cancelled except for when myelodysplastic syndrome is indicated.

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

**Necessary Information**
1. Provide a reason for testing 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. A pathology and/or flow cytometry report may be requested by the Genomics Laboratory to optimize testing and aid in interpretation of results.

**Specimen Required**

**Container/Tube:** Green-top (sodium heparin)

**Specimen Volume:** 2-3 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.
Test Definition: CHRBM
Chromosomes, Hematologic, BM

Forms
If not ordering electronically, complete, print, and send a Hematopathology/Cytogenetics Test Request (T726) 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

<table>
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<tr>
<th>Specimen Type</th>
<th>Temperature</th>
<th>Time</th>
<th>Special Container</th>
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<tbody>
<tr>
<td>Bone Marrow</td>
<td>Ambient (preferred)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Refrigerated</td>
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Clinical and Interpretive

Clinical Information
Chromosomal abnormalities play a central role in the pathogenesis, diagnosis, and treatment monitoring of many hematologic disorders. Cytogenetic studies on bone marrow may be helpful in many malignant hematologic disorders as the observation of a chromosomally abnormal clone may be consistent with a neoplastic process.

Certain chromosome abnormalities may help classify a malignancy. As examples, the Philadelphia (Ph) chromosome, also referred to as der(22)t(9;22)(q34;q11.2), is usually indicative of chronic myeloid leukemia (CML) or acute leukemia; t(8;21)(q22;q22) defines a specific subset of patients with acute myeloid leukemia; and t(8;14)(q24.1;q32) is associated with Burkitt lymphoma.

Cytogenetic studies are also used to monitor patients with hematologic neoplasia and may identify disease progression, such as the onset of blast crisis in CML, which is often characterized by trisomy 8, isochromosome 17q, and multiple Ph chromosomes.

Conventional chromosome studies of B-cell disorders are not always successful because B lymphocytes do not proliferate well in cell culture. The agent CpG 7909 (CpG) is a synthetic oligodeoxynucleotide that binds to the Toll-like receptor 9 (TLR9) present on B cells, causing B-cell activation. In the laboratory setting, CpG may be used as a mitogen to stimulate B cells in patient specimens, thus allowing identification of chromosome abnormalities. CpG stimulation reveals an abnormal karyotype in approximately 80% of patients with chronic lymphocytic leukemia, and the karyotype is complex in 20% to 25% of cases. Several studies have reported that increased genetic complexity revealed by CpG-stimulated chromosome studies confers a less favorable time to first treatment, treatment response, and overall survival.

Reference Values
An interpretative report will be provided.

Interpretation
To ensure the best interpretation, it is important to provide some clinical information to verify the appropriate type of cytogenetic study is performed.
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 congenital 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 (FISH) study option that could be performed.

**Cautions**

In some cases, fluorescence in situ hybridization (FISH) studies may detect some disorders better than conventional chromosome studies:

- For plasma cell proliferative disorders (PCPDs) such as multiple myeloma, FISH studies will detect chromosome anomalies with prognostic significance much more often than conventional chromosome studies. In this situation, PCPD / Plasma Cell Proliferative Disorder, FISH, Bone Marrow is recommended.

**Interfering factors:**

- Technical:
  - Excessive transport time
  - Insufficient bone marrow specimen
  - Not processing the bone marrow as indicated before shipping the specimen
  - Not sending the first aspirate from the patient's bone marrow draw

- Biological:
  - Abnormalities missed due to sampling error
  - Subtle structural chromosome abnormalities may be missed occasionally
  - Neoplastic cells not dividing

**Clinical Reference**


Test Definition: CHRBM
Chromosomes, Hematologic, BM

Performance

Method Description
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. In the harvest process, the cells are exposed to colcemid and hypotonic solution, and are then fixed. 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 cells analyzed 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 anomalies.

When a specimen is received from a patient age 30 or older with a reason for referral of chronic lymphocytic leukemia (CLL), small lymphocytic lymphoma (SLL), lymphocytosis, or Waldenstrom macroglobulinemia, a CpG-stimulated culture will be added and 10 additional cells will be analyzed. Additional metaphases may be analyzed from the unstimulated or CpG-stimulated cell cultures if necessary to provide an accurate interpretation. 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. (Unpublished Mayo method)

PDF Report
No

Day(s) and Time(s) Test Performed
Specimens are processed Monday through Sunday.

Results reported Monday through Friday; 8 a.m.-5 p.m.

Analytic Time
9 days

Maximum Laboratory Time
11 days

Specimen Retention Time
Four weeks

Performing Laboratory Location
Rochester

Fees and 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 Regional Manager. For assistance, contact Customer Service.
Test Definition: CHRBM
Chromosomes, Hematologic, BM

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 U.S. 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

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