MAYO CLINIC LABORATORIES

Test Definition: MYEFL

Myelodysplastic Syndrome, Flow Cytometry, Bone Marrow

Overview

Useful For

Detecting increased blasts

Characterizing blast phenotypes

Identifying abnormal patterns of myeloid maturation as seen in myelodysplastic syndromes and other clonal myeloid neoplasms

Providing additional adjunct diagnostic information in cases with equivocal or suspicious morphologic features for myelodysplastic syndrome (MDS), MDS/myeloproliferative neoplasms including chronic myelomonocytic leukemia, and other clonal myeloid neoplasms

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
FCINS	Flow Cytometry Interp,16 or greater	No, (Bill Only)	No

Additional Tests

Test Id	Reporting Name	Available Separately	Always Performed
ADD1	Flow Cytometry, Cell Surface, Addl	No, (Bill Only)	Yes
FIRST	Flow Cytometry, Cell Surface, First	No, (Bill only)	Yes

Testing Algorithm

This assay uses 2 panels for identifying cell populations of interest and for characterizing their phenotypic features. In the myelodysplastic syndrome panel, blasts are identified by CD45/side scatter gating strategy and by CD34 expression; promyelocytes are identified by bright CD13, CD33, and CD117 expression without CD34; granulocytes and precursors are defined by their variable expression of CD13 and CD16 according to their maturational stages. Abnormal patterns of myeloid maturation are determined according to the presence or absence of the following features: distinct blast increases over 5%; heterogeneous blast distribution on CD13/HLA-DR plot; expression of CD2, CD7, or CD56 on blasts; and disrupted granulocytic maturation on CD13/CD16 plot.(1,2)

Additionally, a triage panel is performed to ensure that monotypic B cells, increased plasma cells, and phenotypically aberrant populations of CD3-positive T cells and CD16-positive/CD3-negative natural killer (NK) cells, if present, are identified. This is necessary especially for cases where the reason for referral is broad, where clonal myeloid neoplasms may not be the only diagnostic consideration, or where there are incomplete clinical history and morphologic data.

These panels are used in combination with any available provided clinical history and morphologic findings to determine if any additional testing may be needed for complete disease characterization. If such additional testing is required, it will be added according to laboratory algorithms at an additional charge per unique antibody tested.

Highlights

This assay, when used in combination with appropriate review of clinical history, morphologic, cytogenetic, and molecular genetic data, may provide helpful diagnostic information in evaluating bone marrow specimens for possible involvement by a myelodysplastic syndrome or a myelodysplastic/myeloproliferative neoplasm including chronic myelomonocytic leukemia.

In addition to detecting increased blasts, this assay also analyzes blast phenotypes **and** patterns of myeloid maturation. The diagnostic contribution of this assay, thus, does not rely solely on identifying blast increases.

This assay is **not** intended for prognostication or monitoring of response to therapy.

Method Name

Immunophenotyping

NY State Available

Yes

Specimen

Specimen Type

Bone Marrow

Additional Testing Requirements

If cytogenetic tests are also desired when collecting MYEFL / Myelodysplastic Syndrome by Flow Cytometry, Bone Marrow, an additional specimen should be submitted. It is important that the specimen be obtained, processed, and transported according to instructions for the other required test.

Shipping Instructions

Specimen must be received within 72 hours of collection.

Specimen Required

Container/Tube:

Preferred: Yellow top (ACD solution A or B)

Acceptable: Lavender top (EDTA), green top (heparin)

Specimen Volume: 2-5 mL

Slides: Include 1 to 2 unstained bone marrow smears labeled with 2 unique identifiers.

Collection Instructions:

1. Submission of bilateral specimens is not required.

2. Send bone marrow specimen in original tube. **Do not aliquot.**
3. Label specimen as bone marrow.

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

Specimen Minimum Volume
1 mL

Reject Due To

Broken or cracked unstained slides	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Bone Marrow	Ambient		

Clinical & Interpretive

Clinical Information
Myelodysplastic syndromes (MDS) encompass a heterogeneous group of clonal hematopoietic neoplasms characterized by cytopenias due to ineffective hematopoiesis, variable degrees of dysmyelopoietic morphologic features, and increased risks of evolution to acute myeloid leukemia. Per 2008 World Health Organization recommendations, a definitive diagnosis of MDS requires identification of 1 or more of the following findings: clear-cut morphologic features of dysplasia in greater than or equal to 10% of the cells in 1 or more of the 3 hematopoietic lineages; increased (but <20%) blood or marrow blasts with or without Auer rods; and well-characterized clonal cytogenetic abnormalities.(3,4)

However, at present, in approximately 50% of MDS patients, no informative or diagnostic clonal cytogenetic abnormalities are identified. Not infrequently, morphologic review of the patient's blood and marrow specimen is inconclusive. And yet it is important to distinguish MDS and other clonal myeloid neoplasms from other nonmalignant and nonneoplastic possibilities in the differential diagnosis such as medication effects or other toxic exposures, copper deficiency, infections, and left-shifted hematopoietic regeneration, among others.

In such settings, when used in conjunction with appropriate clinical and morphologic findings, flow cytometry immunophenotyping analysis can provide additional diagnostic information to help distinguish an underlying clonal hematopoietic neoplasm from a reactive or secondary response.(2,5)

Reference Values

An interpretive report will be provided. This test will be processed as a laboratory consultation. An interpretation of the immunophenotypic findings and, if available, morphologic features will be provided by a board-certified hematopathologist for every case.

Interpretation

The final interpretation integrates the quantity of blasts; blast phenotype with respect to CD13/HLA-DR expression and/or abnormal coexpression of CD2, CD7, or CD56; and myeloid maturation patterns based on CD13/CD16 plot. In combination, the total number of abnormalities detected and the distinctiveness of the abnormalities themselves help determine the likelihood of specimen involvement by a clonal myeloid neoplasm.

Cautions

The results of this assay are not intended to be standalone and need to be correlated with the patient's clinical history, findings from the primary morphologic review of blood and marrow slides, and other laboratory features including cytogenetic and molecular genetic results.

The quantity of blasts as identified and reported in this assay **should not** form the basis upon which the final diagnosis or subclassification of acute myeloid leukemia, myelodysplastic syndrome, myeloproliferative neoplasms, or myelodysplastic/myeloproliferative neoplasms is established. For that purpose, the percentage of blasts derived from a morphologic review of the primarily prepared blood and marrow slides is required per 2008 World Health Organization guidelines (if unable to perform at the client site, order PATHC / Pathology Consultation).

This assay **should not** be used to monitor response to therapy.

Broken or cracked unstained slides are not compatible with the instrumentation used in our performing laboratories and will be rejected. Additional material may be requested.

Clinical Reference

1. Kussick SJ, Fromm JR, Rossini A, et al. Four-color flow cytometry shows strong concordance with bone marrow morphology and cytogenetics in the evaluation for myelodysplasia. Am J Clin Pathol. 2005;124(2):170-181
2. Jevremovic D, Timm MM, Reichard KK, et al. Loss of blast heterogeneity in myelodysplastic syndrome and other chronic myeloid neoplasms. Am J Clin Pathol. 2014;142(3):292-298
3. Swerdlow SH, Campo E, Harris NL, et al, eds. WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues. IARC Lyon; 2008: 88-107
4. Cioc AM, Nguyen PL. Myelodysplastic syndromes. In: Hsi E, ed. Hematopathology. Elsevier Saunders; 2012: 523-546
5. van de Loosdrecht AA, Westers TM. Cutting edge: flow cytometry in myelodysplastic syndromes. J Natl Compr Canc Netw. 2013;11(7):892-902

Performance

Method Description

Flow cytometry immunophenotyping of bone marrow is performed using the following antibodies:
Myelodysplastic syndrome panel: CD2, CD7, CD13, CD15, CD16, CD33, CD34, CD36, CD38, CD45, CD56, CD64, CD117, and HLA-DR

Triage panel: CD3, CD10, CD16, CD19, CD34, CD45, and kappa and lambda immunoglobulin light chains. Additional panels performed per algorithmic approach.(Unpublished Mayo Method)

PDF Report
No

Day(s) Performed
Monday through Saturday

Report Available
1 to 4 days

Specimen Retention Time
14 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 was developed using an analyte specific reagent. 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-Flow cytometry; first cell surface, cytoplasmic or nuclear marker x 1
88185-Flow cytometry; additional cell surface, cytoplasmic or nuclear marker (each) x18
88189-Flow Cytometry Interpretation, 16 or More Markers (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
MYEFL	MDS by Flow Cytometry, BM	In Process

Result ID	Test Result Name	Result LOINC® Value
CK086	MDS Panel	No LOINC Needed

CK092	Final Diagnosis	22637-3
CK093	Special Studies	30954-2
CK094	Microscopic Description	22635-7