MAYO CLINIC LABORATORIES

Test Definition: LLPT

Leukemia/Lymphoma Immunophenotyping, Flow Cytometry, Tissue

Overview

Useful For

Evaluation of tissues for potential involvement by:
-Chronic lymphoproliferative disorders
-Malignant lymphomas
-Acute lymphoblastic leukemia
-Acute myelogenous leukemia

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
FCINT	Flow Cytometry Interp, 2-8 Markers	No, (Bill Only)	No
FCIMS	Flow Cytometry Interp, 9-15 Markers	No, (Bill Only)	No
FCINS	Flow Cytometry Interp,16 or greater	No, (Bill Only)	No

Additional Tests

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

Testing Algorithm

When this test is ordered, a screening panel and a professional interpretation will always be charged. The screening panel will be charged based on number of makers tested (FIRST for first marker, ADD1 for each additional marker). The interpretation will be set based on markers tested in increments of 9 to 15, or 16 and greater. In addition, reflex testing may occur to fully characterize a disease state or clarify any abnormalities from the screening test. Reflex tests will be performed at an additional charge for each marker tested (FIRST if applicable, ADD1 if applicable).

The tissue panel is initially performed to evaluate for monotypic B cells by kappa and lambda immunoglobulin light chain expression, CD5, CD10, CD19, CD20, and CD23.Increased numbers of blasts and plasma cells are identified by CD45 expression along with side scatter gating. The panel can also evaluate T cells with CD3, CD5, and CD7. Additionally, viability is assessed on all tissue specimens using 7-AAD (7-amino actinomycin d) exclusion.

This panel, together with the provided clinical history and morphologic review is used to determine what, if any, further testing is needed for disease diagnosis or classification. If additional testing is required, it will be added per algorithm to

fully characterize a disease state with a charge per unique antibody tested.

In addition to reflexing flow cytometric panels, fluorescence in situ hybridization (FISH), molecular testing or cytochemical stains may be recommended by the Mayo Clinic pathologist to facilitate diagnosis. They will contact the referring provider or pathologist to confirm the addition of these tests.

If no abnormalities are detected by the initial panel, no further flow cytometric assessment will be performed unless otherwise indicated by specific features of the clinical presentation or prior laboratory results.

Special Instructions

- Hematopathology Patient Information

Method Name

Immunophenotyping

NY State Available

Yes

Specimen

Specimen Type

Tissue

Ordering Guidance

Order LCMS / Leukemia/Lymphoma Immunophenotyping, Flow Cytometry, Varies if the specimen is a fresh (less than 4 days post-collection), unfixed, non-embedded bone marrow core biopsy, bone or bone lesion. This is an equivalent source for bone marrow aspirate **only in the event of a dry tap** during the bone marrow harvesting procedure. Indicate “dry tap" in performing lab notes or paperwork when submitting this specimen type.

This test is **not intended** for product of conception (POC) specimens. For POC specimens see CMAPC / Chromosomal Microarray, Autopsy, Products of Conception, or Stillbirth.

Shipping Instructions

Specimen must arrive within 4 days of collection.

Necessary Information

The following information is required:

1. Pertinent clinical history, including reason for testing or clinical indication/morphologic suspicion
2. Provide the following:

-Tissue type

-Location

-Pathology/diagnostic report, including the client surgical pathology case number

Specimen Required

Submit 1 of the following specimens:

Preferred
Specimen Type: Tissue
Supplies: Hank's Solution (T132)
Container/Tube: Sterile container with 15 mL of tissue culture medium (eg, Hank's balanced salt solution, RPMI, or equivalent)
Specimen Volume: 5 mm(3) or larger biopsy
Collection Instructions:
1. Place tissue into a sterile container with 15 mL of tissue culture medium (eg, Hank's balanced salt solution, RPMI, or equivalent).
2. Send intact specimen (**do not mince**)
3. Specimen **cannot** be fixed.
Specimen Stability Information: Ambient 4 days/Refrigerated 4 days

Acceptable
Specimen Type: Fine needle aspirate (FNA)
Supplies: Hank's Solution (T132)
Container/Tube: Sterile container with 15 mL of tissue culture medium (eg, Hank's balanced salt solution, RPMI, or equivalent)
Specimen Volume: Entire collection
Collection Instructions:
1. Collect FNA and transfer entire collection into a sterile container with 15 mL of tissue culture medium (eg, Hank's balanced salt solution, RPMI, or equivalent).
2. Send intact specimen (**do not mince**)
3. Specimen **cannot** be fixed.
Specimen Stability Information: Ambient 4 days/Refrigerated 4 days

Forms

1. Hematopathology Patient Information (T676)
2. If not ordering electronically, complete, print, and send a Hematopathology/Cytogenetics Test Request (T726) with the specimen.

Specimen Minimum Volume

1 mm(3)

Reject Due To

Fixed or paraffin-embedded tissue	Reject
Minced tissue	Reject
Dry tissue	Reject

without transport medium	

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Tissue	Refrigerated (preferred)		
	Ambient		

Clinical & Interpretive

Clinical Information

Cellular immunophenotyping, characterizing cells by using antibodies directed against cell surface markers, is generally regarded as a fundamental element in establishing a diagnosis of tissue involvement by hematolymphoid malignancies, when used in conjunction with morphologic assessment. It is also an essential component in subclassification of hematolymphoid malignancies when present.

Reference Values

An interpretive report will be provided.

Interpretation

This test will be processed as a laboratory consultation. An interpretation of the immunophenotypic findings and correlation with the morphologic features will be provided by a hematopathologist for every case.

Normal tissues typically contain a mixture of B cells with polytypic surface immunoglobulin light chain expression and T cells with unremarkable expression of the T cell-associated antigens CD3, CD5, and CD7. Typically, no appreciable blast population is present by CD45 and side scatter analysis.

Cautions

It is well recognized that a negative flow cytometry result does not exclude tissue involvement by hematolymphoid malignancy. This may be attributable to sampling bias, although some malignancies, such as Hodgkin lymphoma, are not detected by this technique.

Viability will be assessed in all tissue specimens. Cases in which the viability is low (<50%) are prone to false-negative results and, therefore, must be interpreted with caution. In cases with viability less than 50%, testing will be attempted but may not be interpretable. Fine-needle aspiration and small biopsy specimens have a higher frequency of low cell counts and poor viability, which may be uninterpretable.

Even when abnormal, in most instances the results of flow cytometry are insufficient for complete subclassification of a hematolymphoid malignancy. Precise subclassification requires correlation with the histopathologic features in paraffin-embedded materials and also, in some instances, the results of cytogenetic analyses.

The tissue used for flow cytometry cannot be subsequently submitted for histopathologic evaluation. For this reason, this technique should be avoided in small biopsy specimens.

Clinical Reference

1. Morice WG, Hodnefield JM, Kurtin PJ, Hanson CA. An unusual case of leukemic mantle cell lymphoma with a blastoid component showing loss of CD5 and aberrant expression of CD10. Am J Clin Pathol. 2004;122(1):122-127
2. Hanson CA. Acute leukemias and myelodysplastic syndromes. In: McClatchey KD, ed. Clinical Laboratory Medicine. Williams and Wilkins; 1994:939-969
3. Jaffe ES, Cossman J. Immunodiagnosis of lymphoid and mononuclear phagocytic neoplasms. In: Rose NR, Friedman H, Fahey JL, eds. Manual of Clinical Immunology. 3rd ed. ASM Press; 1987:779-790
4. Witzig TE, Banks PM, Stenson MJ, et al. Rapid immunotyping of B-cell non-Hodgkin's lymphomas by flow cytometry. A comparison with the standard frozen-section method. Am J Clin Pathol. 1990;94(3):280-286
5. Jevremovic D, Dronca RS, Morice WG, et al. CD5+ B-cell lymphoproliferative disorders: Beyond chronic lymphocytic leukemia and mantle cell lymphoma. Leuk Res. 2010;34(9):1235-1238
6. Jevremovic D, Olteanu H. Flow cytometry applications in the diagnosis of T/NK-cell lymphoproliferative disorders. Cytometry B Clin Cytom. 2019;96(2):99-115
7. Shi M, Jevremovic D, Otteson GE, Timm MM, Olteanu H, Horna P. Single antibody detection of T-Cell receptor alpha beta clonality by flow cytometry rapidly identifies mature T-Cell neoplasms and monotypic small CD8-positive subsets of uncertain significance. Cytometry B Clin Cytom. 2020;98(1):99-107

Performance

Method Description

Flow cytometric immunophenotyping of tissues is performed using the following antibodies:
Tissue Panel: CD3, CD5, CD7, CD10, CD19, CD20, CD23, CD45, 7-AAD, and kappa and lambda immunoglobulin light chains.

Possible Additional Panels: Performed per algorithmic approach:

T-cell Panel: CD2, CD3, CD4, CD5, CD7, CD8, CD45, TRBC1, and gamma/delta

Acute Panel: CD2, CD3, CD5, CD7, CD13, CD15, CD16, CD19, CD20, CD33, CD34, CD36, CD38, CD45, CD56, CD64, CD117, and HLA-DR

Myeloperoxidase (MPO)/terminal deoxynucleotidyl transferase (TdT) (MPO/TdT) Panel: cytoplasmic CD3, CD13, cytoplasmic CD22, CD34, CD45, cytoplasmic CD79a, nuclear TDT, and cytoplasmic MPO

Plasma Cell Panel: CD19, CD38, CD45, CD138, and cytoplasmic kappa and lambda immunoglobulin light chains.(Keren P, McCoy JP, Carey J, eds. Flow Cytometry in Clinical Diagnosis. 4th ed. ASCP Press; 2007; Betters DM: Use of flow cytometry in clinical practice. J Adv Pract Oncol. 2015;6[5]:435-440)

PDF Report

No

Day(s) Performed
Monday through Saturday

Report Available
1 to 4 days

Specimen Retention Time
Remaining tissue 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 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)
88187-Flow Cytometry Interpretation, 2 to 8 Markers (if appropriate)
88188-Flow Cytometry Interpretation, 9 to 15 Markers (if appropriate)
88189-Flow Cytometry Interpretation, 16 or More Markers (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
LLPT	Leukemia Lymphoma Phenotype, Tissue	In Process

Result ID	Test Result Name	Result LOINC® Value
19562	Accession Number	57723-9
19569	Material:	81178-6
19568	Specimen:	31208-2

19574	Final Diagnosis:	34574-4
19563	Referring Pathologist/Physician	46608-6
19564	Ref Path/Phys Address	74221-3
19565	Place of Death:	21987-3
19566	Date and Time of Death:	81956-5
19567	Date of Autopsy:	75711-2
19570	Tissue Discription:	22634-0
19572	Clinical History:	22636-5
19576	Revision Description:	81317-0
19577	Signing Pathologist:	19139-5
19578	Special Procedures:	30954-2
19579	SP Signing Pathologist:	19139-5
19580	*Previous Report Follows*	22639-9
19581	Addendum:	35265-8
19582	Addendum Comment:	22638-1
19583	Addendum Pathologist:	19139-5
19571	Microscopic Description	22635-7
19573	Final Diagnosis:	34574-4
19575	Special Studies	30954-2
CK139	LLPT Result	No LOINC Needed