# Test Definition: LLTOT

Leukemia and Lymphoma
Immunophenotyping, Technical Only, 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

**Note:** This test is only available to clients who have MayoAccess or MayoLink.

The client is responsible for the interpretation and billing of the professional component; Mayo Clinic will bill the technical component only.

The testing process begins with a screening panel. The screening panel will be charged based on the number of markers tested (FIRST for first marker, ADD1 for each additional marker). Additional testing may be performed at an additional charge for each marker tested (ADD1, as applicable) if needed to fully characterize a disease state or clarify any abnormalities from the screening panel.

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 tissue panel also includes CD3, CD5, and CD7 antibodies to evaluate T

cells. Additionally, viability is assessed on all tissue specimens using 7-AAD (7-Amino-Actinomycin D) exclusion.

This initial testing, together with the provided clinical history and morphologic review, is used to determine what, if any, additional 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.

Cases requiring testing for granular lymphocytic leukemia (killer-cell immunoglobulin-like receptor panel) will have an interpretation added which will be performed by a Mayo Clinic pathologist at an additional charge.

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

This test is available to clients through MayoAccess or MayoLink.

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

Order LLTOF / Leukemia and Lymphoma Phenotyping, Technical Only, 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.

### Shipping Instructions

**Specimen must arrive within 4 days of collection.**

### Necessary Information

**The following information is required:**

1. Reason for testing
2. Tissue type
3. Tissue location
4. 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

Tissue: 1 mm(3); Fine needle aspirate: See Specimen Required

## Reject Due To

| | |
|---|---|
| Fixed, | Reject |

| | |
|---|---|
| paraffin-embedded, or minced tissue | |
| Dry tissue without transport medium | Reject |

### 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.

This is a technical only test and does not include interpretation. At any point, clients may request to have a Mayo Clinic hematopathologist provide an interpretation at an additional charge.

### Reference Values
Not applicable

### Interpretation
Report will include a summary of the procedure.

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, 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, CD19, CD20, CD33, CD34, CD45, CD56, CD117 and HLA-DR

Myeloperoxidase/terminal deoxynucleotidyl transferase (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
Supplemental

### Day(s) Performed
Monday through Sunday

### 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 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
88184-Flow cytometry; first cell surface, cytoplasmic or nuclear marker x 1
88185-Flow cytometry; additional cell surface, cytoplasmic or nuclear marker (each)
Additional CPTs may be added if consultative help is needed with the case, or algorithm dictates Mayo consultant involvement.
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 |
|---|---|---|
| LLTOT | Leukemia/Lymphoma; Tech Only Tissue | 101119-6 |

# Test Definition: LLTOT

Leukemia and Lymphoma

Immunophenotyping, Technical Only, Tissue

| Result ID | Test Result Name | Result LOINC® Value |
|---|---|---|
| 621506 | LLTOT Result | 69052-9 |
| 621507 | Final Diagnosis | 22637-3 |
| 621508 | Special Studies | 30954-2 |
| 621509 | Microscopic Description | 22635-7 |
| CKR3 | Reason for Referral | 42349-1 |
| CKS3 | Tissue Type | 31208-2 |
| CKT3 | Tissue Location | 22633-2 |
| CKPN3 | Surgical Pathology Number | 80398-1 |