MAYO CLINIC LABORATORIES

Test Definition: TALMF

T-Cell Acute Lymphoblastic Leukemia/Lymphoma (ALL), Specified FISH, Varies

Overview

Useful For

Detecting a neoplastic clone associated with the common chromosome abnormalities and classic rearrangements observed in patients with T-cell acute lymphoblastic leukemia (T-ALL) using client specified probes

An adjunct to conventional chromosome studies in patients with T-ALL

Evaluating specimens in which standard cytogenetic analysis is unsuccessful

Identifying and tracking known chromosome abnormalities in patients with T-ALL and monitoring response to therapy

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
TALMB	Probe, Each Additional (TALMF)	No, (Bill Only)	No

Testing Algorithm

This test includes a charge for the probe application, analysis, and professional interpretation of results for 1 probe set (2 individual fluorescence in situ hybridization (FISH) probes). Additional charges will be incurred for all reflex or additional probe sets performed.

If the patient is being treated for known abnormalities, indicate the abnormality and which probes should be used.

When specified, any of the following probes will be performed:
1p33 rearrangement, TAL1/STIL
t(5;14), TLX3/BCL11B
5q32 rearrangement, PDGFRB break-apart
7q34 rearrangement, TRB break-apart
t(6;7)(q23;q34) MYB/TRB
t(7;10)(q34;q24) TRB/TLX1
t(7;11)(q34;p15) TRB/LMO1
t(7;11)(q34;p13) TRB/LMO2
+9/9p-, CDKN2A/D9Z1
9p24.1 rearrangement, JAK2 break-apart
t(9;22) or ABL1 amplification, ABL1/BCR
9q34 rearrangement, ABL1 break-apart
t(10;11), MLLT10/PICALM
11q23 rearrangement, MLL (KMT2A) break-apart

t(4;11)(q21;q23) AFF1/MLL
t(6;11)(q27;q23) MLLT4(AFDN)/MLL
t(9;11)(p22;q23) MLLT3/MLL
t(10;11)(p12;q23) MLLT10/MLL
t(11;19)(q23;p13.1) MLL/ELL
t(11;19)(q23;p13.3) MLL/MLLT1
14q11.2 rearrangement, TRAD break-apart
t(8;14)(q24.1;q11.2) MYC/TRAD
t(10;14)(q24;q11.2) TLX1/TRAD
t(11;14)(p15;q11.2) LMO1/TRAD
t(11;14)(p13;q11.2) LMO2/TRAD
-17/17p-, TP53/D17Z1

Method Name
Fluorescence In Situ Hybridization (FISH)

NY State Available
Yes

Specimen

Specimen Type
Varies

Ordering Guidance
This test is intended for instances when limited T-cell acute lymphoblastic leukemia (ALL) fluorescence in situ hybridization (FISH) probes are needed. The FISH probes to be analyzed must be specified on the request, otherwise test processing may be delayed in order to determine intended analysis.
-For an **adult** patient, if the entire T-cell ALL FISH panel is preferred, order TALAF / T-Cell Acute Lymphoblastic Leukemia/Lymphoma (ALL), FISH, Adult, Varies.
-For a **pediatric** patient, if the entire T-cell ALL FISH panel is desired, order TALPF / T-Cell Acute Lymphoblastic Leukemia/Lymphoma (ALL), FISH, Pediatric, Varies.
-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 COGTF / T-Cell Acute Lymphoblastic Leukemia/Lymphoma (ALL), Children's Oncology Group Enrollment Testing, FISH, Varies.

If the patient clinically relapses, a conventional chromosome study is useful to identify cytogenetic changes in the neoplastic clone or the possible emergence of a new therapy-related myeloid clone.

At diagnosis, conventional cytogenetic studies (CHRBM / Chromosome Analysis, Hematologic Disorders, Bone Marrow) and a complete TALAF / T-Cell Acute Lymphoblastic Leukemia/Lymphoma (ALL), FISH, Adult, Varies or TALPF / T-Cell

Acute Lymphoblastic Leukemia/Lymphoma (ALL), FISH, Pediatric, Varies should be performed, depending on patient's age.

For patients with T-cell lymphoma, order TLPDF / T-Cell Lymphoma, Diagnostic FISH, Varies.

For testing paraffin-embedded tissue samples from patients with T-lymphoblastic lymphoma, order TLBLF / T-Cell Lymphoblastic Leukemia/Lymphoma, FISH, Tissue. If a paraffin-embedded tissue sample is submitted for this test, this test will be canceled and TLBLF will be added and performed as the appropriate test.

Shipping Instructions

Advise Express Mail or equivalent if not on courier service.

Necessary Information

1. **A list of probes requested for analysis is required.** Probes available for this test are listed in the Testing Algorithm section.
2. A reason for testing and a flow cytometry and/or a bone marrow pathology report should be submitted with each specimen. The laboratory will not reject testing if this information is not provided; however, appropriate testing and/or interpretation may be compromised or delayed in some instances. If not provided, an appropriate indication for testing may be entered by Mayo Clinic Laboratories.

Specimen Required

Submit only 1 of the following specimens:

Preferred
Specimen Type: Bone marrow
Container/Tube:
Preferred: Yellow top (ACD)
Acceptable: Green top (heparin) or lavender top (EDTA)
Specimen Volume: 2 to 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.
3. Send bone marrow specimen in original tube. **Do not aliquot.**

Acceptable
Specimen Type: Blood
Container/Tube:
Preferred: Yellow top (ACD)
Acceptable: Green top (heparin) or lavender top (EDTA)
Specimen Volume: 6 mL
Collection Instructions:
1. Invert several times to mix blood.
2. Send whole blood specimen in original tube. **Do not aliquot.**

Forms

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

Specimen Minimum Volume

Blood: 2 mL

Bone Marrow: 1 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
Varies	Ambient (preferred)		
	Refrigerated		

Clinical & Interpretive

Clinical Information

Acute lymphoblastic leukemia (ALL) accounts for approximately 70% of all childhood leukemia cases (ages 0 to 19 years), making it the most common type of childhood cancer.

Approximately 85% of pediatric cases of ALL are of B-cell lineage (B-ALL) and 15% are of T-cell lineage (T-ALL). T-ALL is more common in adolescents than younger children and accounts for 25% of adult ALL. When occurring as a primary lymphoblastic lymphoma (LBL), approximately 90% are T-cell lineage versus only 10% B-cell lineage. T-LBL often present as a mediastinal mass in younger patients, with or without concurrent bone marrow involvement.

Specific genetic abnormalities are identified in the majority of cases of T-ALL, although many of the classic abnormalities are "cryptic" by conventional chromosome studies and must be identified by fluorescence in situ hybridization (FISH) studies. Each of the genetic subgroups is important to detect and can be critical prognostic markers.

A combination of cytogenetic and FISH testing is currently recommended in all pediatric and adult patients to characterize the T-ALL clone for the prognostic genetic subgroups. A summary of the characteristic chromosome abnormalities identified in T-ALL is listed in the following table.

Table. Common Chromosome Abnormalities in T-cell Acute Lymphoblastic Leukemia

Cytogenetic change	Genes involved
del(1p33)	*TAL1/STIL*
t(5;14)(q35;q32)	*TLX3/BCL11B*
t(5q32;var)	*PDGFRB*
t(10;11)(p13;q14)	*MLLT10/PICALM*

Episomal amplification	*ABL1*
del(9p)	*CDKN2A*(*p16*)
t(9p24.1;var)	*JAK2*
t(9q34;var)	*ABL1*
t(11q23;var)	*MLL*(*KMT2A*)
t(4;11)(q21;q23)	*AFF1*/*MLL*(*KMT2A*)
t(6;11)(q27;q23)	*MLLT4*(*AFDN*)/*MLL*(*KMT2A*)
t(9;11)(p22;q23)	*MLLT3*/*MLL*(*KMT2A*)
t(10;11)(p13;q23)	*MLLT10*/*MLL*(*KMT2A*)
t(11;19)(q23;p13.1)	*MLL*(*KMT2A*)/*ELL*
t(11;19)(q23;p13.3)	*MLL*(*KMT2A*)/*MLLT1*
t(7q34;var)	*TRB*
t(6;7)(q23;q34)	*MYB*/*TRB*
t(7;10)(q34;q24)	*TRB*/*TLX1*
t(7;11)(q34;p15)	*TRB*/*LMO1*
t(7;11)(q34;p13)	*TRB*/*LMO2*
t(14q11.2;var)	*TRAD*
t(8;14)(q24.1;q11.2)	*MYC*/*TRAD*
t(10;14)(q24;q11.2)	*TLX1*/*TRAD*
t(11;14)(p15;q11.2)	*LMO1*/*TRAD*
t(11;14)(p13;q11.2)	*LMO2*/*TRAD*
del(17p)	*TP53*
Complex karyotype (> or =4 abnormalities)	

Reference Values

An interpretive report will be provided.

Interpretation

A neoplastic clone is detected when the percent of cells with an abnormality exceeds the normal reference range for any given probe.

The absence of an abnormal clone does not rule out the presence of a neoplastic disorder.

Cautions

This test is not approved by the US Food and Drug Administration, and it is best used as an adjunct to existing clinical and pathologic information.

Bone marrow is the preferred sample type for this fluorescence in situ hybridization test. If bone marrow is not available, a blood specimen may be used if there are neoplastic cells in the blood specimen (as verified by a

hematopathologist).

Supportive Data

Each probe was independently tested and verified on unstimulated peripheral blood and bone marrow specimens. Normal cutoffs were calculated based on the results of 25 normal specimens. Each probe set was evaluated to confirm the probe set detected the abnormality it was designed to detect.

Clinical Reference

1. Swerdlow SH, Campo E, Harris NL, et al, eds: WHO Classification of Tumours. Vol 2. WHO Classification of Tumours of Haematopoietic and Lymphoid Tissues. 4th ed. IARC Press; 2017
2. Gesk S, Martin-Subero JI, Harder L, et al: Molecular cytogenetic detection of chromosomal breakpoints in T-cell receptor gene loci. Leukemia. 2003;17:738-745
3. Chin M, Mugishima H, Takamura M, et al: Hemophagocytic syndrome and hepatosplenic (gamma)(delta) T-cell lymphoma with isochromosome 7q and 8 trisomy. J Pediatr Hematol Oncol. 2004;26(6):375-378
4. Graux C, Cools J, Michaux L, Vandenberghe P, Hagemeijer A : Cytogenetics and molecular genetics of T-cell acute lymphoblastic leukemia: from thymocyte to lymphoblast. Leukemia. 2006;20:1496-1510
5. Cayuela JM, Madani A, Sanhes L, Stern MH, Sigaux F: Multiple tumor-suppressor gene 1 inactivation is the most frequent genetic alteration in T-cell acute lymphoblastic leukemia. Blood 1996;87:2180-2186
6. Hayette S, Tigaud I, Maguer-Satta V, et al: Recurrent involvement of the *MLL* gene in adult T-lineage acute lymphoblastic leukemia. Blood. 2002;99:4647-4649
7. Graux C, Cools J, Melotte C, et al: Fusion of *NUP214* to *ABL1* on amplified episomes in T-cell acute lymphoblastic leukemia. Nat Genet. 2004;36:1084-1089

Performance

Method Description

This test is performed using commercially available and laboratory-developed probes. Deletion of the *CDKN2A* locus on chromosome 9 and *TP53* on chromosome 17 are detected using enumeration strategy probes. Rearrangements involving *TAL1/STIL, PDGFRB, TRB, JAK2, ABL1, MLL* (*KMT2A*), and *TRAD* are detected using dual-color break-apart (BAP) strategy probes. Dual-color, dual-fusion fluorescence in situ hybridization (D-FISH) strategy probe sets are used to detect t(5;14), t(9;22), t(10;11), and in reflex testing when rearrangements of *MLL, TRB*, or *TRAD* genes are detected. Amplification of the *ABL1* gene region (9q34) is detected using a D-FISH probe strategy. For enumeration and BAP strategy probe sets, 100 interphase nuclei are scored; 200 interphase nuclei are scored when D-FISH probes are used. All results are expressed as the percent abnormal nuclei.(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available

7 to 10 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
88271x2, 88275x1, 88291x1-FISH Probe, Analysis, Interpretation; 1 probe set
88271x2, 88275x1 - FISH Probe, Analysis; each additional probe set (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
TALMF	ALL (T-cell), Specified FISH	In Process

Result ID	Test Result Name	Result LOINC® Value
614325	Result Summary	50397-9
614326	Interpretation	69965-2
614327	Result Table	93356-4
614328	Result	62356-1
GC134	Reason for Referral	42349-1
GC135	Probes Requested	78040-3
GC136	Specimen	31208-2
614329	Source	31208-2
614330	Method	85069-3
614331	Additional Information	48767-8
614332	Disclaimer	62364-5
614333	Released By	18771-6