Acute Lymphoblastic Leukemia FISH Panels

Acute lymphoblastic leukemia (ALL) is an aggressive leukemia of B- or T-lineage immature lymphoid cells. B-cell ALL (B-ALL) is primarily a disease of early childhood. Fluorescence in situ hybridization (FISH) testing identifies rearrangements in specific genes used in risk stratification and treatment decisions for children and adults newly diagnosed with B-ALL.

Disease Overview

Incidence

B-ALL occurs in 1.6/100,000 individuals per year, and is the most common leukemia in childhood.[1]

Symptoms

Bone marrow failure (eg, anemia, thrombocytopenia, leukopenia) and constitutional symptoms (eg, fever, lethargy, weight loss) are common.[2] In children, joint or extremity pain may be the only presenting symptom.[3,4]

Genetics

Pediatric ALL	Adult ALL	Ph-Like ALL
BCR-ABL1	*BCR-ABL1*	*CRLF2*
KMT2A (MLL)	*KMT2A (MLL)*	*JAK2*
ETV6-RUNX1	*TCF3 (E2A)*	*EPOR*
CEP4	*IGH*	*CSF1R*
CEP10	*MYC*	*ABL1*
		ABL2
		PDGFRB

Ph, Philadelphia chromosome

Test Interpretation

Test Results

Pediatric FISH

- Normal: no evidence of *BCR-ABL1* t(9;22), *KMT2A* (MLL) rearrangement, *ETV6-RUNX1* t(12;21), *RUNX1* amplification or copy number gain with *CEP4* and/or *CEP10*
- Abnormal: one of the above rearrangements or translocations detected

Adult FISH

- Normal: no evidence of *BCR-ABL1* t(9;22), *KMT2A* (*MLL*) rearrangement, *TCF3* (*E2A*) rearrangement, *IGH* rearrangement, or *MYC* rearrangement
- Abnormal: one of the above rearrangements/translocations or copy number change detected

Tests to Consider

Acute Lymphoblastic Leukemia (ALL) Panel by FISH, Adult 2002647

Method: Fluorescence in situ Hybridization (FISH)

- Recommended FISH panel for adults with newly diagnosed B-ALL
- Probes include *BCR-ABL1* t(9;22), *KMT2A* (*MLL*) 11q23 rearrangement (partner not determined), *TCF3* (*E2A*) rearrangement (partner not determined), *IGH* rearrangement (partner not determined), *MYC* rearrangement

Acute Lymphoblastic Leukemia (ALL) Panel by FISH, Pediatric 2002719

Method: Fluorescence in situ Hybridization (FISH)

- Recommended FISH panel for children with newly diagnosed B-ALL
- Probes include *BCR-ABL1* t(9;22), *KMT2A* (*MLL*) 11q23 rearrangement (partner not determined), *ETV6-RUNX1*, t(12;21), *CEP4*, *CEP10*

Ph-Like Acute Lymphoblastic Leukemia (ALL) Panel by FISH 3000455

Method: Fluorescence in situ Hybridization (FISH)

- Diagnosis, prognosis, and monitoring of *BCR-ABL1*-like B-ALL
- Probes include *CRLF2* rearrangement, *JAK2* rearrangement, *EPOR* rearrangement, *CSF1R* rearrangement, *ABL1* rearrangement, *ABL2* rearrangement, *PDGFRB* rearrangement
- Order when other major prognostic markers (eg, *BCR-ABL1*, *ETV6-RUNX1*) are negative

Testing Strategy

At diagnosis, the minimum ALL workup includes bone marrow aspirate for morphology, immunophenotyping, cytogenetics (eg, karyotyping and fluorescence in situ hybridization [FISH]), and other molecular testing, as indicated.

To order FISH probes individually, see Chromosome FISH, Interphase 2002298.

See Related Tests

Ph-Like ALL FISH

- Normal: no evidence of rearrangement involving *CRLF2*, *JAK2*, *EPOR*, *CSF1R*, *ABL1*, *ABL2*, or *PDGFRB*
- Abnormal: one of the described rearrangements detected

Prognostic Issues

More information on the prognostic significance of identified genetic rearrangements can be found in the ARUP Consult Acute Lymphoblastic Leukemia topic.

Limitations

Panels detect only the specific aberrations targeted by the FISH probes included. Chromosome alterations outside the regions complementary to these probes will not be detected.

References

1. American Cancer Society. Key statistics for acute lymphocytic leukemia. [Last revised: Jan 2020; Accessed: Jul 2020]
2. Terwilliger T, Abdul-Hay M. Acute lymphoblastic leukemia: a comprehensive review and 2017 update. Blood Cancer J. 2017;7(6):e577. PubMed
3. National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology, acute lymphoblastic leukemia, version 2.2019. [Accessed: Oct 2019]
4. Paul S, Kantarjian H, Jabbour EJ. Adult Acute Lymphoblastic Leukemia. Mayo Clin Proc. 2016; 91 (11): 1645-1666. PubMed

Related Information

Acute Lymphoblastic Leukemia - ALL

Related Tests

Leukemia/Lymphoma Phenotyping Evaluation by Flow Cytometry 3001780

Method: Flow Cytometry

Chromosome Analysis, Bone Marrow 2002292

Method: Giemsa Band

Chromosome Analysis, Bone Marrow with Reflex to Genomic Microarray 2007130

Method: Giemsa Band/Genomic Microarray (Oligo-SNP array)

Cytogenomic SNP Microarray - Oncology 2006325

Method: Genomic Microarray (Oligo-SNP Array)

Cytogenomic Molecular Inversion Probe Array, FFPE Tissue - Oncology 2010229

Method: Molecular Inversion Probe Array

Chromosome FISH, Interphase 2002298

Method: Fluorescence in situ Hybridization (FISH)

BCR-ABL1, Qualitative with Reflex to BCR-ABL1 Quantitative 2005010

Method: Reverse Transcription Polymerase Chain Reaction

TPMT and NUDT15 3001535

Method: Polymerase Chain Reaction/Fluorescence Monitoring

Thiopurine Methyltransferase, RBC 0092066

Method: Enzymatic/Quantitative Liquid Chromatography-Tandem Mass Spectrometry

Method: Quantitative Liquid Chromatography/Tandem Mass Spectrometry

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