B-Cell Acute Lymphoblastic Leukemia Minimal Residual Disease Detection by Flow Cytometry

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B-cell acute lymphoblastic leukemia (B-ALL) is an aggressive leukemia of B-cell lineage involving immature lymphoid cells.[1] It is primarily a childhood disease.[1] B-ALL minimal residual disease (MRD) testing by flow cytometry may be useful for prognosis and monitoring of the disease and for the detection of MRD but should not be used for initial diagnosis; instead, a comprehensive flow cytometry panel is recommended. For information on initial diagnostic testing, refer to the Leukemia/Lymphoma Phenotyping Evaluation by Flow Cytometry Test Fact Sheet. For more information about the overall testing strategy for B-ALL, refer to the ARUP Consult Acute Lymphoblastic Leukemia - ALL topic.

Featured ARUP Testing

B-Lymphoblastic Leukemia (B-ALL) Minimum Residual Disease Detection by Flow Cytometry 3000724

Method: Flow Cytometry

- Use to detect MRD in patients of all ages previously diagnosed with B-ALL.
- Available antigen markers include CD3, CD9, CD10, CD13, CD19, CD20, CD22, CD24, CD33, CD34, CD38, CD45, CD58, CD66b, CD71, and Syto 16.
- Anti-CD19 resistant markers (CD10, CD19, CD20, CD22, CD24, CD34, CD38, CD45, CD58, CD66b) will be used for bone marrow testing unless a Children's Oncology Group (COG) protocol is specified and there is no prior history of COG bone marrow testing.
- Orders for whole blood testing will be canceled if the patient is 31 years or older or if there is a prior history of COG whole blood testing.

Test Description

This test is useful for the evaluation of MRD, specifically B-ALL blasts. Leukocytes are evaluated for the presence of immature/blast cells.

Antigen Markers Used and Reported

The reported markers vary based on the specimen submitted and whether the Children's Oncology Group (COG) protocol is specified at the time of ordering. The COG protocol is typically not specified unless the patient is on a COG protocol. If the COG protocol is specified, the time point and specimen type must be indicated.

A 10-color panel suitable for use in the context of anti-CD19 therapy (including monoclonal antibodies or chimeric antigen receptor T-cell therapy [CAR-T]) is used and offers superior sensitivity in most clinical scenarios.

Markers Used and Reported by Protocol Specified and Specimen Type

Protocol Specified	Specimen Type Submitted	Antigen Markers Used and Reported
None	Bone marrow	CD10, CD19, CD20, CD22, CD24, CD34, CD38, CD45, CD58, CD66b
COG	Bone marrow with prior history of COG bone marrow	CD10, CD19, CD20, CD22, CD24, CD34, CD38, CD45, CD58, CD66b
COG	Day 29 bone marrow without prior history of COG bone marrow	CD3, CD9, CD10, CD13, CD19, CD20, CD33, CD34, CD38, CD45, CD58, CD71, Syto 16
None	Whole blood	None; testing will be canceled
COG	Whole blood with prior history of COG whole blood testing	None; testing will be canceled
COG	Day 8 whole blood without prior history of COG whole blood testing	If patient is <31 years of age: CD10, CD19, CD20, CD34, CD45, Syto 16 If patient is ≥31 years of age: none; testing will be canceled

Test Interpretation

Sensitivity/Specificity

Analytic Specificity

Discrimination by forward scatter, side scatter, CD45 intensity, and specific antigen markers

Analytic Sensitivity (Limit of Detection)

Non-COG panel: 0.0072% of viable leukocytes

- This panel is suitable for use in patients treated with anti-CD19 therapy.

COG panel: 0.01% of nucleated mononuclear cells

- This panel has poor sensitivity in patients treated with anti-CD19 therapy.

Results

- Antigen markers will be reported as positive or negative.
- Positive results will be reported as a percentage of viable leukocytes or nucleated mononuclear cells.
- Pathologist interpretation of findings is included.

Limitations

- The COG panel has poor sensitivity in patients treated with an anti-CD19 therapy; consider the non-COG panel.
- Poor cell viability may adversely affect antigens and impede the ability to properly identify neoplastic cells.
- Hemodilution or low numbers of events collected may affect sensitivity.
  - First-pull aspirate is recommended for maximum sensitivity.
- Flow results should not be used alone to diagnose malignancy.
  - Results should be interpreted in conjunction with morphology, clinical information, and other necessary ancillary tests for a definitive diagnosis.

References

1. National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology: pediatric acute lymphoblastic leukemia. Version 3.2024. Updated Oct 2023; accessed Nov 2023.