High-Sensitivity Liquid Biopsy MRD Monitoring in Acute Myeloid Leukemia Using cfDNA and NGS

Executive Summary

Minimal Residual Disease (MRD) monitoring is essential for therapeutic guidance and relapse prediction in Acute Myeloid Leukemia (AML). Traditional MRD evaluation relies on bone marrow aspirates and flow cytometry, which can be invasive and inconsistent. Recent clinical evidence demonstrates that cell-free DNA (cfDNA) extracted from peripheral blood and analyzed via targeted Next-Generation Sequencing (NGS) provides a non-invasive, sensitive, and repeatable approach for MRD tracking. Integrating the **Zinexts MagPurix® automated cfDNA extraction system** into this workflow ensures standardized and reproducible sample preparation, making cfDNA-based MRD surveillance practical for routine clinical use.

Key Findings

1. cfDNA Detects MRD with High Sensitivity

- Strong correlation between cfDNA and CTC mutation levels (R^2 = 0.927). • cfDNA consistently detected higher tumor signal intensity (Median VAF 0.0035) vs CTCs (Median VAF 0.0007).
- cfDNA detected molecular persistence even when MFC or CTC-based MRD was negative.

Performance Attribute	cfDNA (MagPurix® Workflow)	CTCs / Bone Marrow Methods
Detection Sensitivity	High (Median VAF 0.0035)	Lower (Median VAF 0.0007)
Correlation Strength	R^2 = 0.927	Variable
Invasiveness	Non-invasive blood sampling	Bone marrow aspiration required
Workflow Efficiency	Automated & reproducible	Manual, variable output
Relapse Signal Timing	Earlier detection observed	Often detected later

2. Automation Improves Workflow Consistency

The MagPurix® automated platform standardizes cfDNA extraction, reducing manual variability and supporting scalable implementation for longitudinal MRD monitoring.

3. Enables Non-Invasive Serial Surveillance

Routine blood-based MRD monitoring allows earlier relapse detection and more frequent disease assessment without the need for repeated bone marrow procedures.

Conclusion

cfDNA-based MRD monitoring analyzed through high-sensitivity NGS represents a clinically valuable advancement in AML care. When paired with the Zinexts MagPurix® automated extraction platform, laboratories can perform reliable, repeatable, and non-invasive MRD surveillance, improving relapse detection and enabling timely therapeutic intervention.

Reference

Álvarez, N., et al. (2024). Detection of minimal residual disease in acute myeloid leukemia: Evaluating utility and challenges. *Frontiers in Immunology*. https://doi.org/10.3389/fimmu.2024.1252258