CLINICAL FEASIBILITY OF PERIPHERAL BLOOD–BASED MRD MONITORING USING THE MISELECT R AML MRD LAIP ASSAY IN ACUTE MYELOID LEUKEMIA

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INTRODUCTION

- Monitoring **measurable residual disease (MRD**) is important for guiding treatment decisions in acute myeloid leukemia (AML).
- Current MRD testing depends on **bone marrow** sampling, which is **invasive** and not suitable for frequent monitoring.
- **Peripheral blood (PB)** offers a less invasive option, but detection sensitivity has been limited.
- **The MiSelect R AML MRD LAIP Assay** uses automated rare-cell enrichment and imaging to detect LAIP-positive myeloblasts in PB with analytical sensitivity down to 5 × 10^{-7}, providing a sensitive and standardized approach for non-invasive MRD monitoring.

AIMS

- To evaluate the analytical performance of the MiSelect R AML MRD LAIP Assay.
- To assess the feasibility of PB-based MRD monitoring in AML patients.
- To compare PB MRD with BM MRD and explore its association with clinical outcomes.

METHOD

- **Analytical validation:**

  Contrived PB samples were spiked with AML samples to test limit of detection (LoD), lower limit of quantification (LLoQ), precision, and reproducibility.
- **Clinical cohort:**

  37 AML patients were enrolled; after exclusions, 16 patients achieving CR/CRi were analyzed (see Figure 1).

  A total of 147 PB and 77 BM samples were collected at diagnosis, post-induction, and follow-up.
- **MRD analysis:**

  Enriched CD117$^+$CD34$^+$CD45 dim/− myeloblasts were analyzed for leukemia-associated immunophenotypes (LAIP), including CD7$^+$, CD19$^+$, CD56$^+$, HLA-DR$^-$, CD15$^+$, NG2$^+$, and CD38$^-$ markers.
- **Statistics:**

  PB vs. BM MRD correlation evaluated by Pearson's r.

  Progression-free survival (PFS) and overall survival (OS) analyzed using Kaplan–Meier and log-rank tests.

RESULTS

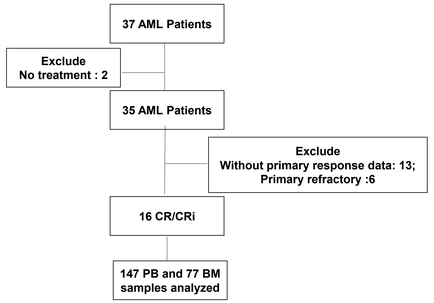


Figure 1. Study flow and sample overview

Table 1. Characteristics of the 37 patients with AML

Age (range)	67 (34-89)
Sex (Male/Female)	21/16
Newly Diagnosed AML No. (%)	29 (78.3)
WBC, 10^9 (range)	9.94 (0.51-185.5)
platelets, 10^{12} (range)	57 (5-227)
Hemoglobin, (range)	7.9 (4.6-10.9)
BM blasts, % (range)	62.5 (15-95)
--- Initial Response ---	
CR/CRi	16
primary refractory	6
Without BM Data	13

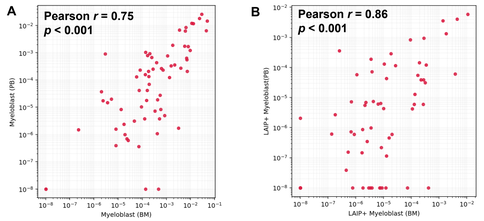


Figure 2. Correlation between PB and BM myeloblast (A) and LAIP$^+$ myeloblast frequencies (B).

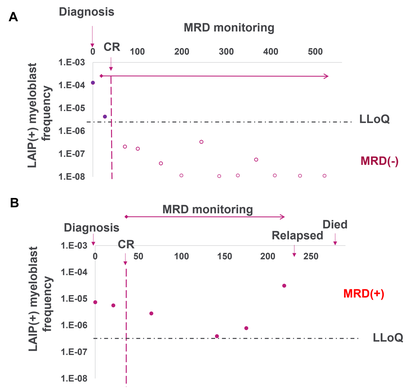


Figure 3. Longitudinal MRD monitoring using PB samples. (A) Patient achieving CR and maintaining PB MRD negativity, with no relapse or death during follow-up. (B) Patient with persistent MRD positivity, later relapsed and died

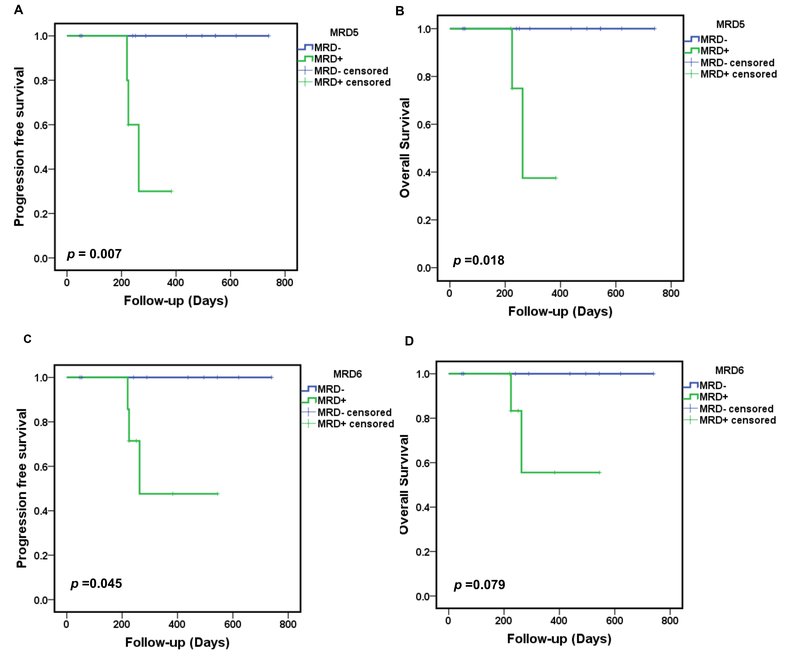
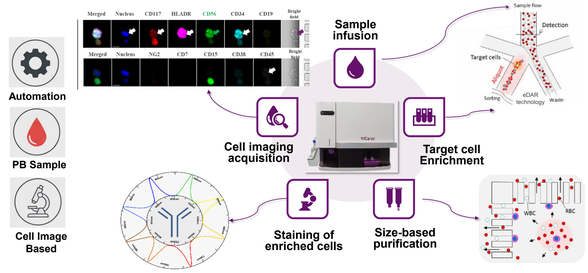


Figure 4. Prognostic impact of PB MRD status. PB MRD at last follow-up < 10^{-5} was significantly associated with longer PFS (A) and OS (B). Using a stricter threshold of PB MRD at last follow-up < 10^{-6}, MRD negativity still predicted improved PFS (C) and a trend toward better OS (D).

MISELECT R AML MRD ASSAY



Metric	Result
Limit of Blank (LoB)	2.88 × 10^{-7}
Limit of Detection (LoD)	4.48 × 10^{-7}
Lower Limit of Quantification (LLoQ)	5.0 × 10^{-7}
Precision (Repeatability & Reproducibility)	Intra-assay 6.15 -10.88%, Inter-assay 0–16.05%, Inter-operator 5.31-11.13%

CONCLUSIONS

- The MiSelect R AML MRD LAIP Assay provides highly sensitive and standardized MRD detection using PB.
- PB MRD levels correlate well with BM MRD, supporting PB as a reliable and less invasive alternative for longitudinal monitoring.
- PB MRD negativity is associated with prolonged progression-free and overall survival, across different cut-offs.
- Serial PB MRD monitoring effectively reflects disease kinetics and may allow earlier relapse detection.
- These findings support the clinical feasibility and prognostic value of PB-based MRD assessment in AML.

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