Artificial Intelligence–Based Diagnostic Accuracy and Clinical Utility for Acute Myeloid Leukemia Detection from Peripheral Blood and Bone Marrow Imaging: A Systematic Review and Meta-analysis

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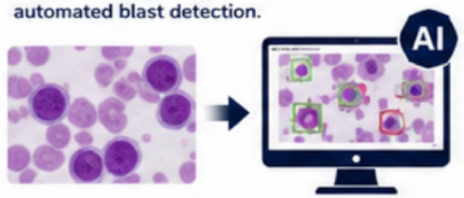
INTRODUCTION / BACKGROUND

Acute Myeloid Leukemia (AML) requires rapid and accurate diagnosis to improve survival outcomes. Artifical intelligence (AI)-based digital pathology models, including convolutional neural networks and transformer architectures, have emerged as promising tools for automated blast detection.



OBJECTIVE

To evaluate the diagnostic accuracy and clinical utility of AI-based imaging models for detecting AML from peripheral blood and bone marrow samples.

METHODS

- Systematic search of PubMed, Scopus, and Web of Science (2018–2026)
- Studies evaluating AI-based AML detection from peripheral blood or bone marrow imaging were included
- Random-effects meta-analysis pooled diagnostic outcomes
- Methodological quality assessed using PROBAST-AI and CLAIM frameworks

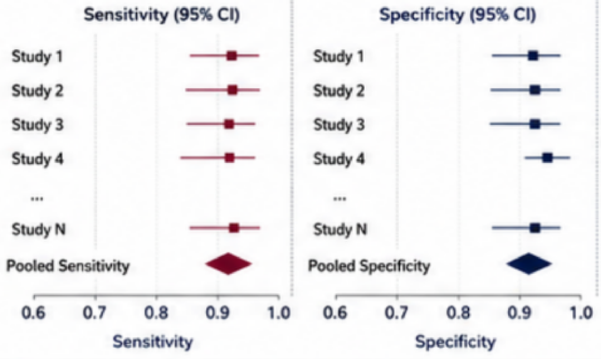
173 Studies	42,850 Patients	>1.2 Million Digital Image Frames

RESULTS

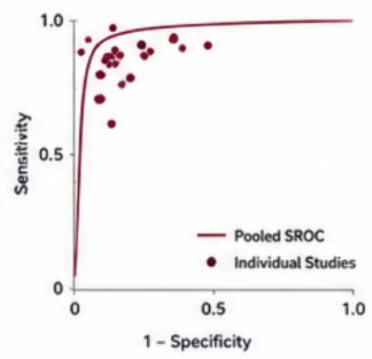
Pooled Diagnostic Accuracy

Sensitivity	Specificity	AUROC	F1-score	Diagnostic Odds Ratio	Positive LR	Negative LR
95.2% (95% CI: 92.4% – 97.1%)	97.6% (95% CI: 95.8% – 98.9%)	0.97 (95% CI: 0.95 – 0.98)	0.94 (95% CI: 0.91 – 0.96)	184.2 (95% CI: 142.5 – 238.1)	39.7 (95% CI: 22.4 – 70.1)	0.049 (95% CI: 0.03 – 0.08)

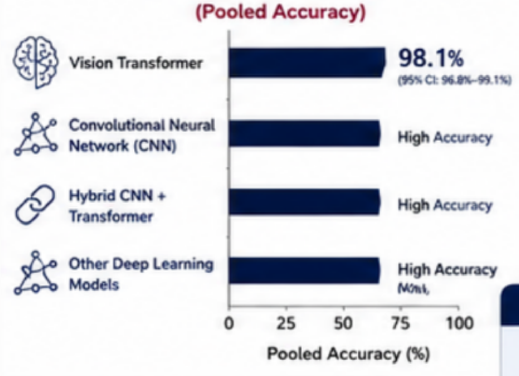
Forest Plot – Pooled Sensitivity and Specificity



SROC Curve



Model Architecture Performance (Pooled Accuracy)



AI Workflow in AML Diagnosis

Summary of Key Findings

- AI models show excellent diagnostic performance for AML detection.
- Vision Transformer architectures achieved the highest pooled accuracy.
- AI integration significantly improves turnaround time and accelerates treatment initiation.
- Strong evidence supports incorporation of AI in hematopathology workflows.

Clinical Utility Outcomes

Diagnostic Turnaround Time Reduced
75.4%
(95% CI: 68.2% – 81.5%)

Time to Initiation of Induction Chemotherapy Shortened
14.2 Hours
(95% CI: 11.5 – 17.8 Hours)

Heterogeneity
$I^2 = 91.2\%$
(High Heterogeneity)

CONCLUSION

AI-based diagnostic systems demonstrate excellent accuracy and substantial patient-centered benefits in AML detection, including faster diagnosis and earlier treatment initiation.

Despite significant heterogeneity, these findings support integration of AI into hematopathology workflows.

Future multicenter studies with external validation and standardized imaging protocols are essential before widespread clinical implementation.