

Comparative evaluation of blast detection in acute leukemia by the Mindray MC-80 digital microscope versus manual microscopy

Dyna M. Medetova, Daria D. Kovaleva, Vladimir S. Vlasov, Yulia V. Mirolubova,
Yulia I. Karpova, Natalia Y. Chernysh, Elena Y. Vasilyeva

Almazov National Medical Research Center, St.Petersburg, Russia



Introduction

Accurate blast identification in peripheral blood is critical for acute leukemia management. While manual microscopy (MM) remains the reference standard, it is subjective and labor-intensive. With the advancements of hematology analyzer, blasts in the peripheral blood could be alarmed at an early stage. However, the diagnostic accuracy should be investigated before the clinical implementation. In this study, the diagnostic performance of the digital microscope MC-80 with software for blood cell morphological assessment for blast detection was evaluated by comparing with MM results.

Methods

The cohort included 100 patients (65% female, aged 5-78 years) with acute leukemia at diagnosis or during therapy. Peripheral blood samples from the Almazov National Medical Research Center were analyzed in parallel by the digital microscope MC-80 (using LabXpert software) and manual microscopy. Two experienced morphologists independently performed manual blast counts per 200 leukocytes. Statistical analysis (SPSS Statistics) employed Spearman's correlation, Passing-Bablok regression, and Bland-Altman analysis, with outliers excluded using Tukey's method.

Results

- The MC-80 achieved 96% sensitivity for blast detection relative to manual microscopy (100%), demonstrating a low false-negative rate. Notably, the only false negatives occurred in samples with minimal blast counts (1/200 cells) by manual review.
- The MC-80 showed systematic overestimation compared with manual microscopy (median 6 [IQR 4.25–14] vs. 5 [IQR 1–8]), with strong correlation ($\rho = 0.825$, $p < 0.001$). Passing-Bablok regression confirmed proportional bias (slope = 1.25; 95% CI, 1.05–1.63), indicating overestimation increases with blast count. This overestimation tendency is favorable for screening purposes.
- Bland-Altman analysis confirmed a mean overestimation of +3.1 blasts per 200 cells (95% limits of agreement, -4.4 to +10.6). This protective bias supports the MC-80 as an effective screening tool while mandating manual confirmation for flagged samples.

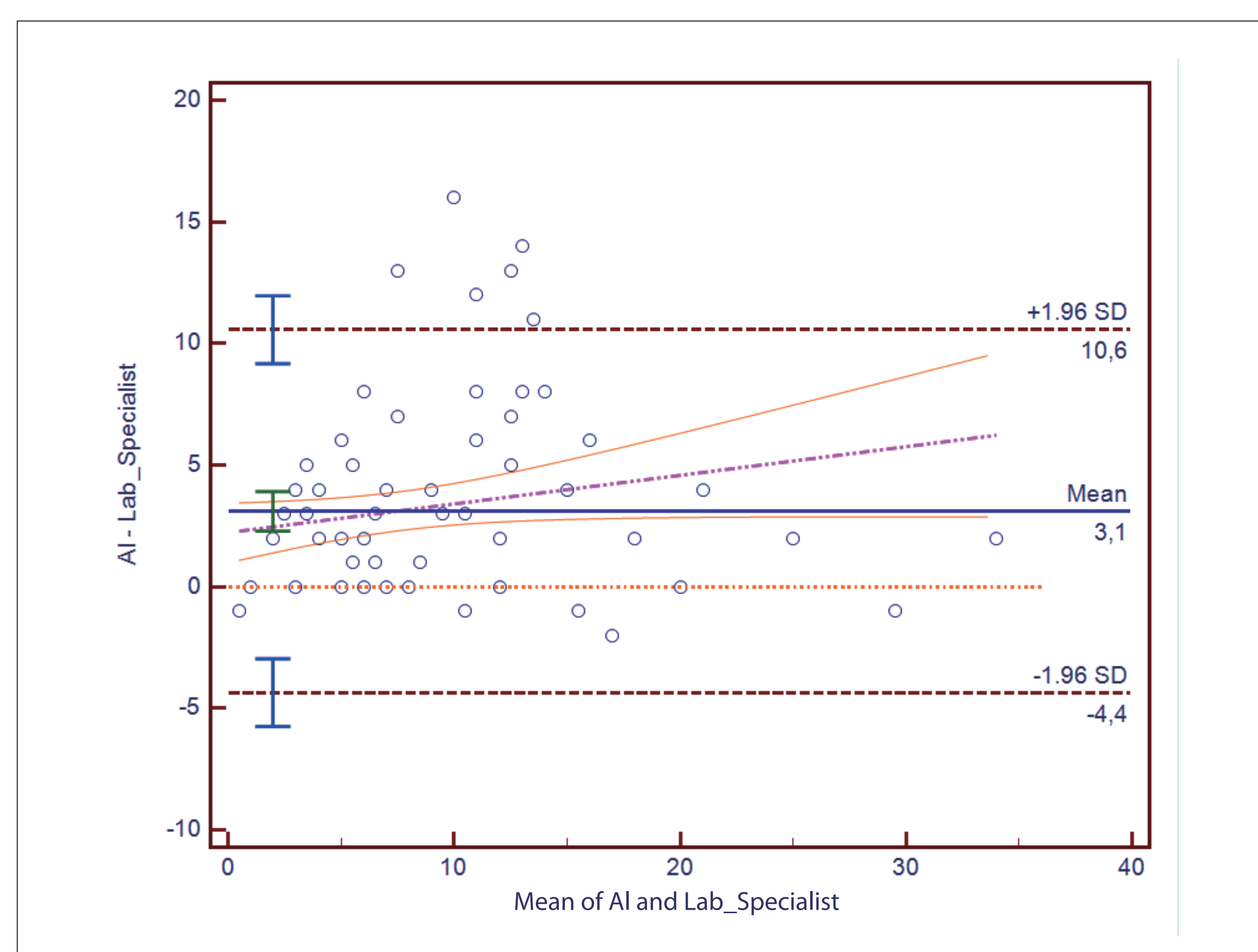


Figure 1. Bland-Altman plot (absolute values)

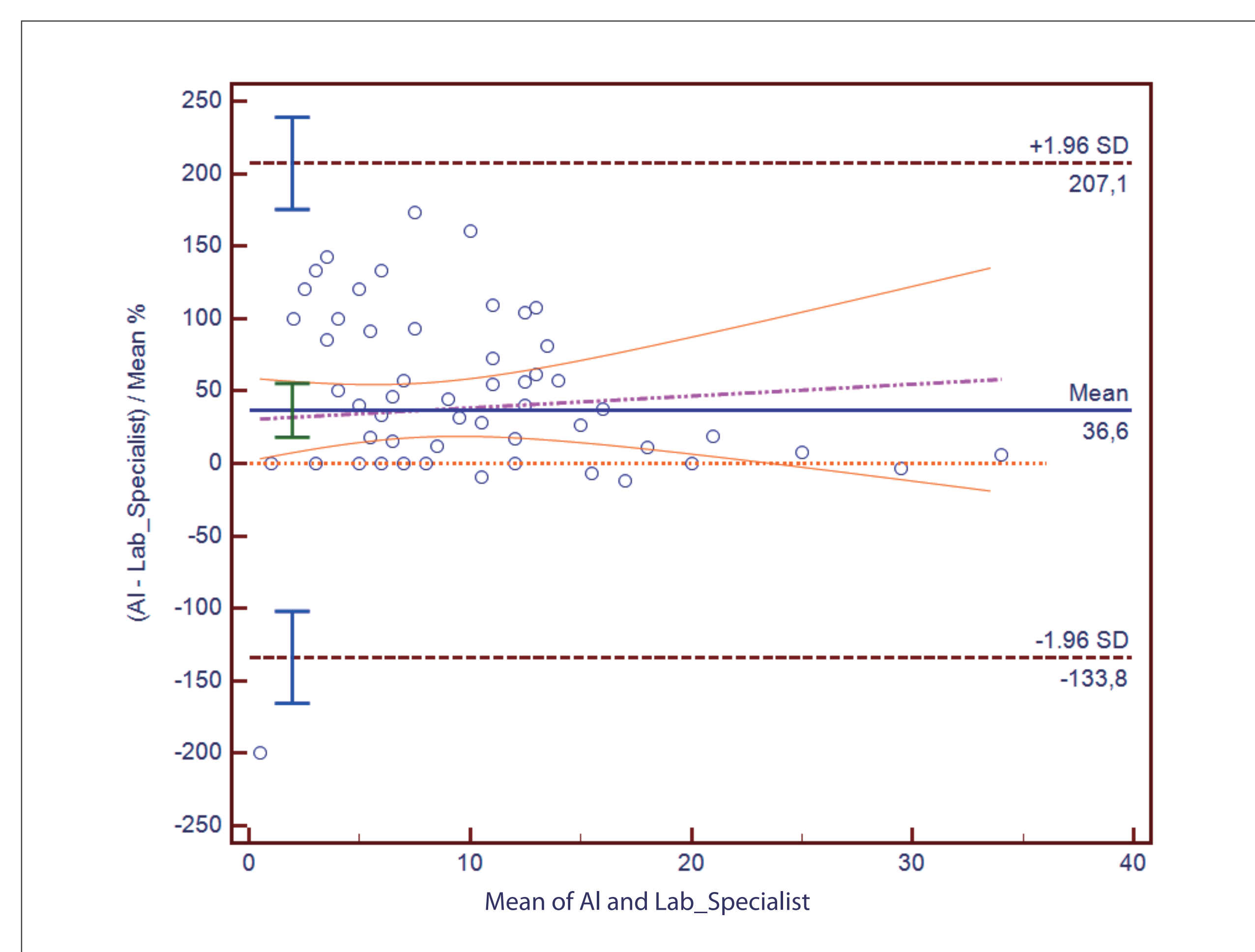


Figure 2. Bland-Altman plot (absolute values)

Conclusions

The Mindray digital microscope MC-80 with software for blood cell morphological assessment is a highly sensitive screening tool for blasts in acute leukemia. Its high negative predictive value and tendency to overcall ensure reliable flagging of true positives, supporting its role as an effective laboratory safeguard that reduces the risk of missed pathology while requiring confirmatory morphology.