Abstract: P1726

Title: ARTIFICIAL INTELLIGENCE-BASED EVALUATION OF TERMINAL ERYTHROID DIFFERENTIATION: PROGNOSTIC IMPLICATIONS IN MYELODYSPLASTIC SYNDROMES

Abstract Type: Poster Presentation

Topic: Novel technologies, techniques and digital analytical tools in hematology

Background:

Terminal Erythroid Differentiation (TED) is a complex and dynamic cellular process involved in the maturation of red blood cell precursors, characterized by successive cellular divisions from proerythroblasts to erythrocytes, exhibiting an increasing pattern.

Recent flow cytometry studies have shown profound abnormalities in erythroid differentiation across all subtypes of Myelodysplastic Syndrome (MDS). Nevertheless, despite the pivotal role of cytomorphology in diagnosis, TED has not been thoroughly assessed using this methodology.

Aims:

We aim to develop an AI algorithm capable of automatically assessing TED in bone marrow aspirates from control and MDS patients, using images digitized through a smartphone. Subsequently, we will investigate TED patterns in MDS patients to assess their correlation with prognosis and clinical characteristics.

Methods:

Bone marrow aspirates (BMA) from 80 MDS patients at three Spanish institutions were digitized using a 3D-printed device, connected to a mobile phone aligned with a conventional optical microscope. An AI algorithm, trained on 400,000 cells, achieved 97.74% accuracy (ROC-AUC) in identifying nucleated cells and classifying them into five categories: non-erythroid, proerythroblasts (PE), basophilic (BA), polychromatic (POLY), and orthochromatic (ORTHO) erythroblasts. MDS patients were categorized into TED-present (≥15% erythroid cells) and TED-absent (<15% erythroid cells) groups. Patients were also categorized based on erythroid cell distribution: TED-normal (>15% of total BM cells with doubling pattern between ORTHO and POLY), TED-incomplete (≥15%, ORTHO>POLY without doubling pattern), no-TED (>15% erythroid cells but ORTHO<POLY), and TED-absent. Survival analysis was assessed with Kaplan-Meier estimator.

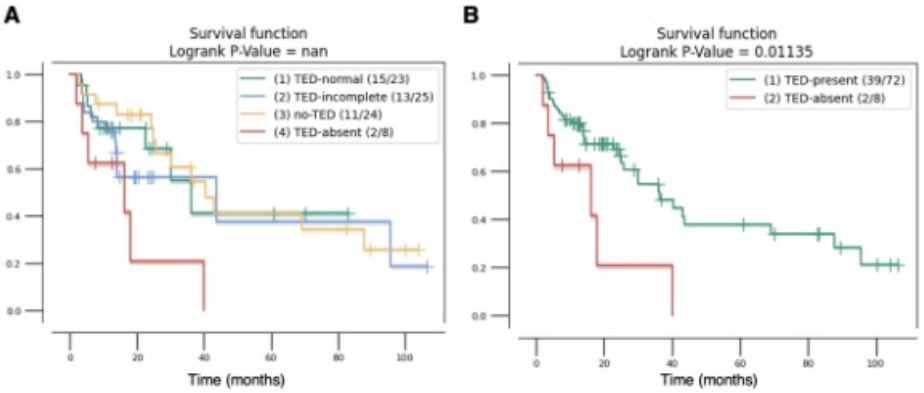
Results:

We first evaluated the kinetics of terminal erythroid growth observed in control bone marrow aspirate (BMA) samples to establish a reference for TED pattern. Among our MDS study cohort, 8 (10%) were classified as TED-absent, 25 (31.25%) as TED-incomplete, 24 (28.75%) as no-TED, and 23 (30%) as TED-normal. . Although our cohort did not exhibit significant variations in overall survival (OS) between TED-absent, TED-incomplete, and TED-normal MDS patients (Figure 1A), survival analysis revealed that MDS patients with TED-absent had lower OS (median OS of 16.17 months, CI95% 1.97-40) in comparison to those with TED-present status (median OS of 36.3 months, CI95% 24.8-69.13, p=0.01) (Figure 1B). On the other hand, MDS patients with TED-absent had a significantly higher number of transfusions 16 weeks pre-treatment, lower reticulocytes, lower hematocrit, higher number of dysplastic BM cell lines and worse IPSS-R index compared to those MDS patients with TED-present (see Table).

Summary/Conclusion:

The results demonstrate that AI is a suitable tool for automatically analyzing TED using BM images. Moreover, the results underscore the prognostic significance of TED, revealing that its absence in MDS patients is associated with worse prognosis and clinical characteristics. Moving forward, further investigations with larger cohorts of MDS patients are needed to delineate differences between various patterns of TED presence,

including normal, incomplete, and no-TED patterns.



Variables	TED-present	TED-absent	p-value
Age, mean (std)	83 (9,6)	80.3 (11.6)	0.545
Sex: Male, N (%)	35 (48.6)	5 (62.5)	0.4585
EPO, mean (std)	73.3 (128.9)	135.7 (56.4)	0.161
Number of transfusions 16 weeks pre-treatment, mean (std)	**2.2 (5.2)**	**10.3 (5.3)**	**0.009**
Hemoglobin, mean (std)	10.5 (2)	9.3 (1.2)	0.064
Platelets, mean (std)	1279.3 (8383)	170.1 (132.3)	0.327
% Blasts BM Cytology, mean (std)	4.1 (4.6)	6.6 (4.5)	0.237
Reticulocytes, mean (std)	**64.1 (34.1)**	**34.3 (11.6)**	**0.0002**
Hematocrit, mean (std)	**32.6 (10.8)**	**28.1 (3.9)**	**0.05**
Number of dysplastic BM cell lines, mean (std)	**2.4 (0.8)**	**2.8 (0.4)**	**0.038**
ECOG, mean (std)	0.9 (1.1)	1.1 (0.8)	0.506
IPSS-R, mean (std)	**3.1 (2.3)**	**5.1 (2)**	**0.05**

Keywords: Erythroid lineage, Erythroid differentiation, Artificial intelligence, Myelodysplastic syndrome