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101.RED CELLS AND ERYTHROPOIESIS, EXCLUDING IRON

Artificial Intelligence RBC Recognition Program for Schistocyte Screening in Cytopenic Patients

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Schistocyte identification is critical for the diagnosis of thrombotic microangiopathies (TMA). It is one of the most common consultative problems for hematologists. The count of schistocytes is poorly defined by automated complete blood count (CBC) machines. Furthermore, morphological evaluation using peripheral blood smear (PBS) staining is time-consuming and exhibits high variability among inexperienced internists. Our aim is to develop and assess the effectiveness of an in-house AI program for recognizing schistocytes. In phase I of this study, we developed an AI program using deep convolutional neural networks trained from schistocyte in blood smear pictures total 1066 pictures of 1066 patients and divided into training set and validation set. In the training set, 10,377 schistocytes were identified, resulting in an accuracy of 0.76977, precision of 0.78487, recall (sensitivity) of 0.97562, and F1-score (harmonic mean of precision and recall) of 0.86991. And in the validation set, 3,564 schistocytes were identified, resulting in an accuracy of 0.68462, precision of 0.73850, recall (sensitivity) of 0.90370, and F1-score of 0.81279. Then, during phase II, PBS from 133 patients from hematology consultation service due to anemia and/or thrombocytopenia were included and scanned by an automated, cell-locating image analysis system. The program's effectiveness was validated by comparing its detection of an increased in schistocytes from patient glass slides (>1%) with the conclusion from at least two out of three hematologists who conducted conventional microscopy readings. The Cohen's kappa agreement between the AI and hematologist readings was 0.583 ($p < 0.001$), representing moderate agreement. There were 58 slides with schistocytes >1% as determined by AI reading, while 34 PBSs were identified as showing a significant increase in schistocytes by hematologists. The sensitivity and specificity of significantly increased schistocyte detection were 97.1% and 74.7%, respectively. Blood smears with significantly increased schistocytes detected by the program had positive predictive and negative predictive values of 43.1% and 93.3%, respectively. Poikilocytosis from thalassemic red cells were the most misinterpreted. In sum, the developed AI program for schistocyte detection showed high sensitivity and acceptable specificity, especially in high prevalence thalassemia populations, indicating its potential to assist inexperienced clinicians and reduce the need for hematologist consultations. Adding more schistocyte samples could improve the program's specificity and efficiency of TMA diagnosis in the future.

Disclosures No relevant conflicts of interest to declare.

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