

Population-adjusted Cut-off Enhances the Diagnostic Efficiency of Hematological Discrimination Formulae for Screening Beta-Thalassemia Trait

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Early detection of beta-thalassemia trait (BTT) is crucial for preventing and controlling beta-thalassemia. Although numerous hematological discrimination formulae (HDF) created based on the complete blood count parameters were proposed as low-cost, the diagnostic efficacy for screening BTT by rapid carrier screening tools in different populations is still controversial. Thus, the present study aimed to understand the diagnostic efficacy of HDF in screening BTT with a population-based cut-off. Data were retrospectively collected from the Thalassemia Center, Teaching Hospital Anuradhapura, and subjected to screening of BTT using HDF retrieved from the literature. Formulae that showed the best performance in both genders were selected and a population-adjusted cut-off was determined by the Receiver operative characteristic (ROC) curve analysis. The diagnostic performance was evaluated and ranked by accuracy measurements, ROC curve analysis, and Youden's index (YI). The predictive performance of each formula was ranked as $1 > \text{AUC} > 0.9$, Excellent; $0.9 > \text{AUC} > 0.8$, Very Good; and $0.8 > \text{AUC} > 0.7$, Good. Results indicated that 7 out of 30 HDF in males ($\text{AUC} > 0.856$, $\text{YI} > 0.713$) and 6 discrimination formulae in females ($\text{AUC} > 0.833$, $\text{YI} > 0.666$) showed 'Very Good' performance detecting BTT with an original cut-off. The population-adjusted cut-off determination and analysis revealed that the BTT diagnostic performance of HDF was enhanced under the adjusted cut-off in both genders (males $\text{AUC} > 0.891$, $\text{YI} > 0.782$; females $\text{AUC} > 0.844$, $\text{YI} > 0.688$). Notably, Shine and Lal, Kerman-I, Nishad, Bordbar, and Roth exhibited an 'Excellent' performance among males. Overall, the findings suggested that the diagnostic performance of the HDF for screening BTT can be enhanced by using a population-adjusted cut-off.

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