

A New Screening Index for Differential Diagnosis of Iron Deficiency Anemia and Thalassemia

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Relevance

Microcytic anemias are a frequent problem in clinical practice, particularly among young patients and women of reproductive age. The most common causes are iron deficiency anemia (IDA) and thalassemia. Despite their similar laboratory manifestations (reduced hemoglobin, erythrocytosis, microcytosis), the management of these conditions differs fundamentally. Iron supplementation in thalassemia is not only ineffective but may be harmful. Therefore, there remains a pressing need to develop simple and reliable laboratory indices for primary differential diagnosis.

We propose a new screening index, calculated as follows:

$$\frac{MCHC \text{ (g/dL)}}{RBC \text{ (million/}\mu\text{L)}}$$

It is known that:

$$MCHC = \frac{Hb \text{ (g/dL)}}{HCT \text{ (\%)}} \times 100$$

Since hematocrit is calculated as:

$$HCT = \frac{MCV(fL) \times RBC \text{ (million/}\mu\text{L)}}{10}$$

then substituting, we obtain:

$$\frac{Hb \text{ (g/dL)}}{MCV(fL) \times RBC \left(\frac{\text{million}}{\mu\text{L}}\right) \times RBC \left(\frac{\text{million}}{\mu\text{L}}\right)} \times 1000$$

Thus, the proposed index may also be expressed as:

$$\frac{Hb \text{ (g/dL)}}{MCV(fL) \times RBC \left(\frac{\text{million}}{\mu\text{L}}\right) \times RBC \left(\frac{\text{million}}{\mu\text{L}}\right)} \times 1000.$$

Objective

To evaluate the diagnostic significance of the newly calculated index in differentiating iron deficiency anemia from thalassemia.

Materials and Methods

The study included 85 patients with microcytic anemia.

- Main group: 50 patients with confirmed thalassemia (confirmed by hemoglobin electrophoresis, without iron deficiency, and prior to initiation of transfusion therapy). Age range: 1–9 years (mean age: 5.3 ± 0.28 years). Peripheral blood parameters were examined using both automated hematology analyzers and morphological evaluation of blood smears. Routine biochemical test results were also analyzed.
 - Of these, 6 patients (12%) had alpha-thalassemia.
 - 44 patients (88%) had beta-thalassemia.
- Control group: 35 patients with laboratory-confirmed iron deficiency anemia (low ferritin and hemoglobin levels), in whom thalassemia carrier status was excluded by hemoglobin electrophoresis. This group consisted of patients with normal HbF levels and normal or reduced HbA2 levels.

The new screening index was calculated for all participants. A diagnostic threshold value of 6.5 was chosen, corresponding to the arithmetic mean of the obtained data. Sensitivity and specificity at this threshold were assessed.

Results

- In the thalassemia group, 40 of 50 patients (80%) had index values above 6.5.
- In the iron deficiency anemia group, 21 of 35 patients (60%) had index values ≤ 6.5 .

At the selected cutoff point (6.5), the new screening index demonstrated:

- Sensitivity: 80%
- Specificity: 60% for diagnosing thalassemia.

Conclusions

The new screening index can serve as an additional diagnostic tool in the differential diagnosis of microcytic anemias. Values above 6.5 permit a reasonable presumption of thalassemia. Given its simplicity of calculation and the availability of required parameters, the index is particularly useful in outpatient settings and in contexts with limited access to specialized diagnostic methods (e.g., ferritin measurement, hemoglobin electrophoresis). Further larger-scale studies comparing this tool with other indices will help refine its clinical utility and determine optimal areas of application.