EVALUATION OF RED CELL MEASUREMENTS AS A DISCRIMINANT BETWEEN IRON DEFICIENCY AND THALASSEMIA TRAIT

THESIS

Submitted for Partial Fulfilment of

M.D. DEGREE

of

CLINICAL AND CHEMICAL PATHOLOGY

By

Dr. MOHAMED HASSAN SHAHEEN
M.B.B.Ch. 1981, M.Sc. Clin. Path. 1986
Ain Shams University

SUPERVISORS

Prof. Dr. WAGEEH NAGUIB IBRAHIM
Prof. of Clinical Pathology
Faculty of Medicine
Ain Shams University

Dr. NADIA MOHAMED MOWAFY
Ass. Prof. of Clinical Pathology
Faculty of Medicine
Ain Shams University

Dr. NEVINE AHMED KASSEM
Lect. of Clinical Pathology
Faculty of Medicine
Ain Shams University

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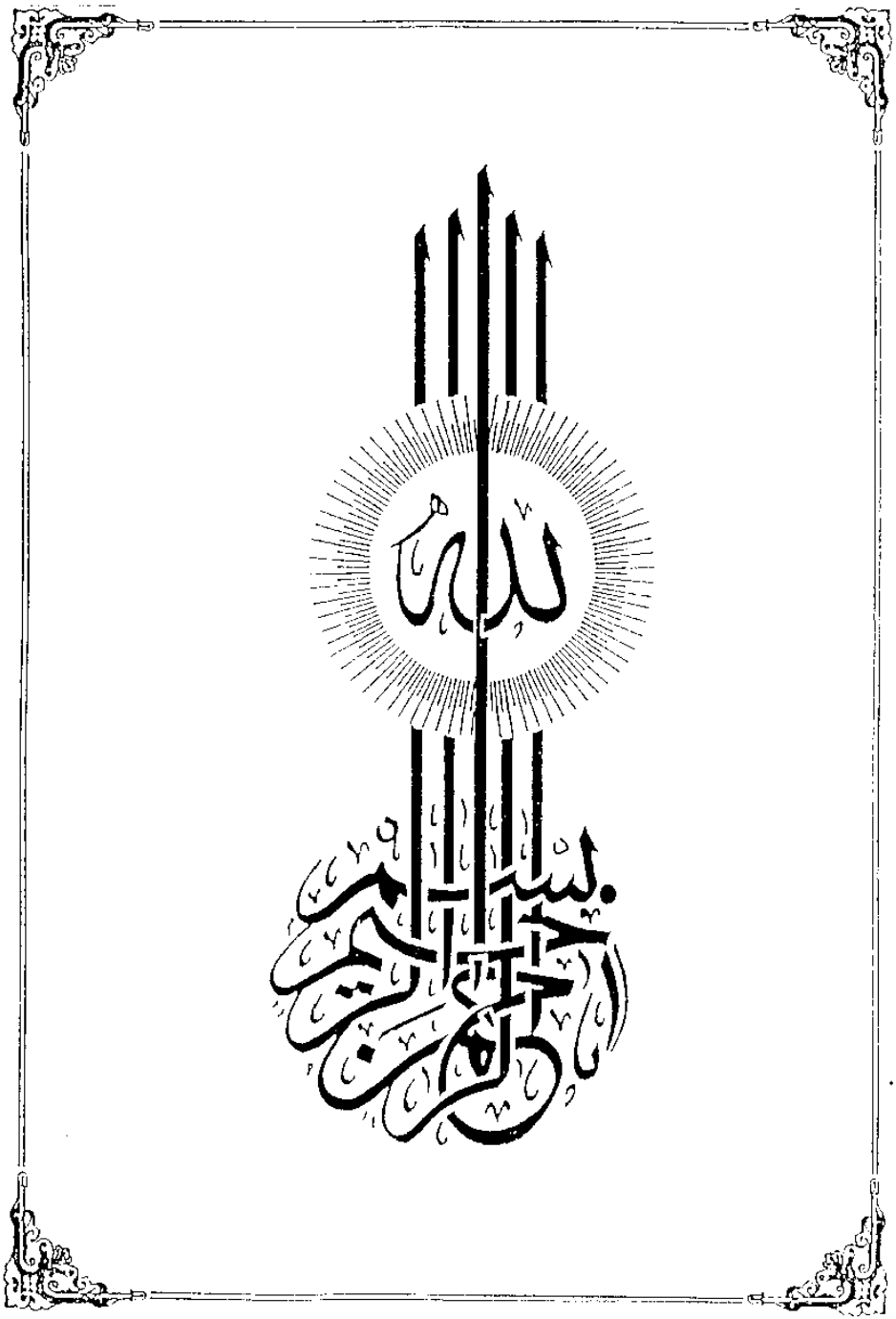

Dedication

To my parents

to my wife

and to my lovely kid ... Hassan

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INTRODUCTION

Thalassemia minor and iron deficiency anemia are by far the most frequent and overlapping causes of microcytosis seen in clinical practice. It is often impossible to differentiate between them either by examining the red blood cell morphology or by the red cell indices. In such circumstances it is customary to confirm the suspected diagnosis by measuring the serum iron and iron binding capacity and the level of hemoglobin A_2 (*England and Fraser*, 1973).

The widespread use of electronic cell counters has generated renewed interest in the interpretation of routine erythrocyte measurements. In particular, the red cell count and erythrocyte size measurements (mean corpuscular volume, red cell distribution width and red cell volume distribution curves) have assumed greater importance. On the other hand the determination of mean corpuscular hemoglobin concentration (MCHC) is of less importance (*Klee et al.*, 1976).

The observation that microcytosis is usually more prominent than anemia in cases of thalassemia minor, or in other words the disproportionate fall in MCV versus RBC count, has been a useful tool in the differentiation from iron deficiency (*England and Fraser*, 1979). All these discriminant functions or decision rules are based solely on erythrocyte measurements routinely available from electronic cell counters. These discriminant functions are:

1. DF = MCV – (5.Hb – RBC – K) (The linear discriminant function of England and Fraser, 1973).

2. $R_1 = \frac{MCV}{RBC}$ (Ratio function of Mentzer, 1973).

3. $R_2 = \frac{MCH}{RBC}$ (Ratio function of Srivastava, 1973).

4. $DF = 0.01 \times MCH \times (MCV)^2$ (Discriminant function of Shine and Lal, 1977).

5. RBC count.

The peripheral blood smear in iron deficiency anemia is known to show anisocytosis, the earliest morphological change encountered even before the development of anemia (*Williams et al.*, 1983). The degree of anisocytosis is said to correlate with the degree of iron deficiency. This observation may explain the early increase of the coefficient of variation of red cell volume distribution measured as RDW (red cell distribution width).

Patients with uncomplicated α or β thalassemia minor do not show anisocytosis in their peripheral blood smear, since the red cell abnormality in thalassemia minor is not progressive. Interestingly, patients with thalassemia minor and no iron deficiency, are thought to have normal or even below normal coefficient of variation of red cell volume distribution i.e. no anisocytosis. The morphological abnormality usually described as anisocytosis on peripheral blood films actually reflects leptocytosis or poikilocytosis (*Klee et al.*, 1976).

Johnson et al. (1983) claimed that the inspection of red cell volume distribution curves (histograms) and the quantitative measurement of anisocytosis, RDW, which are routinely available from multifunctional automatic cell counters, are significantly more accurate ($p < 0.01$) in distinguishing iron deficiency from