A STUDY OF THE PREVALENCE OF MICROCYTOSIS WITHOUT ANEMIA IN EGYPTIANS AND ITS IMPORTANCE

THESIS

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By

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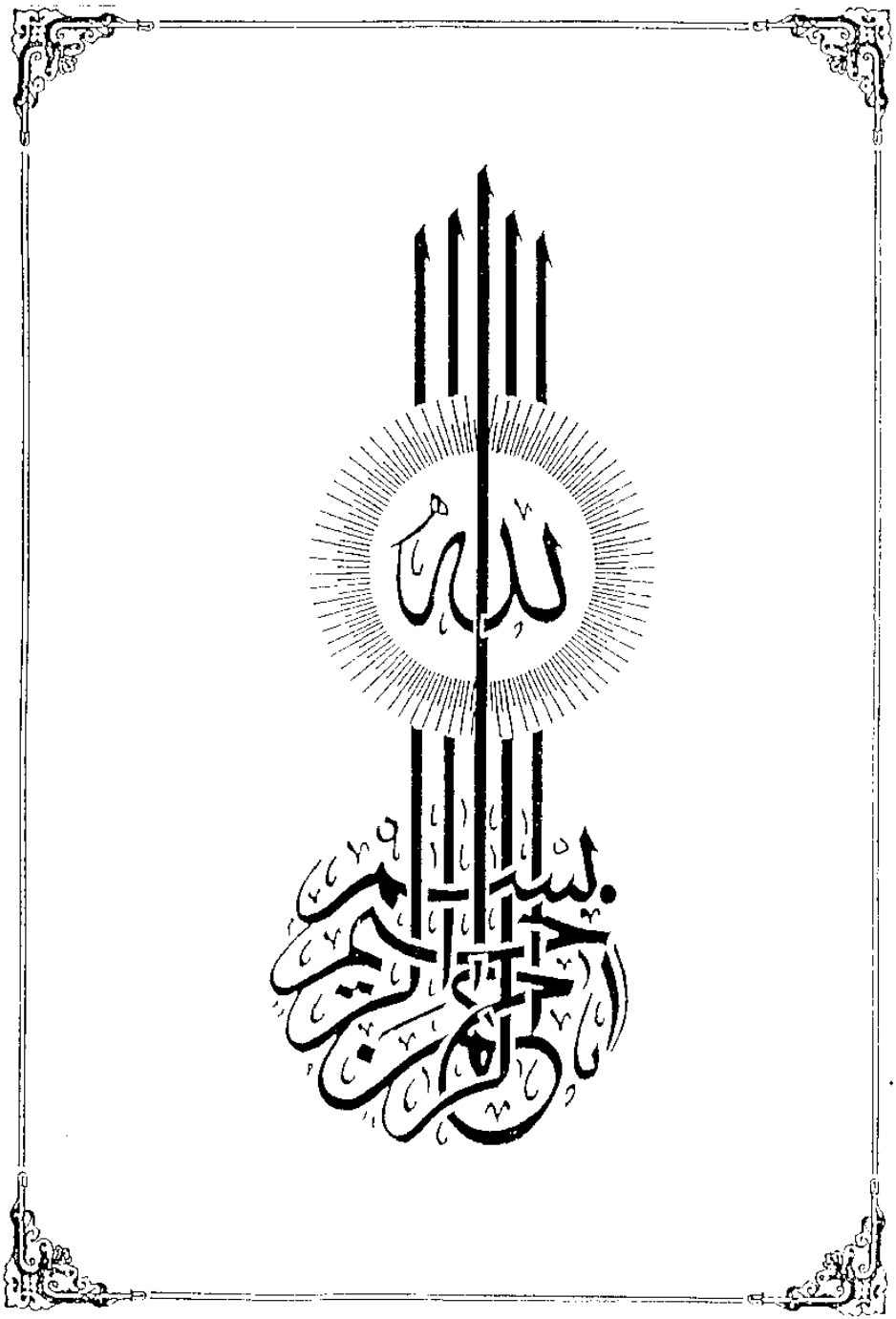

CONTENTS

INTRODUCTION & AIM OF THE WORK 1

REVIEW OF LITERATURE

I) THE RED CELL

- Erythropoiesis 3
- Red cell morphology 7
- Red cell indices 13
- Microcytosis 18

II) IRON DEFICIENCY

- Iron 22
- Iron deficiency anemia 24

III) NORMAL & ABNORMAL HEMOGLOBINS

- Normal hemoglobins 32
- Abnormal hemoglobins
  * Hemoglobinopathies 37
  * Thalassemias 43

MATERIALS & METHODS 57

RESULTS & DISCUSSION 80

REFERENCES 102

SUMMARY & CONCLUSION 115

ARABIC SUMMARY

CONTENTS OF TABLES

(1)	Hematology reference control for the coulter counter	65
(2)	Calculation of fitted values of RBCs in males	77
(3)	" " " " " " "females	78
(4)	Frequency distribution of MCV	83
(5)	" " RBCs count	85
(6)	" " " hemoglobin	86
(7)	" " " MCH	87
(8)	" " " MCHC	88
(9)	Summary of means of parameters	89
(10)	Means of RBCs & MCV	90
(11)	" " Hemoglobin & MCV	93
(12)	" " MCH & MCV	94
(13)	" " MCHC & MCV	95
(14)	Differentiation between iron deficiency and thalassemia trait in males	99
(15)	" " " females	99

CONTENTS OF FIGURES

(1)	Hypothetical scheme of hematopoiesis	4
(2)	Distribution of hemoglobinopathies & thalassemias	45
(3)	Request card	59
(4),(5)	Photo of coulter counter model"S"	61
(6)	Diagramatic representation of sample & subsample	82
(7)	" " " % of cases & MCV	84
(8)	Relation of MCV & RBCs in males	91
(9)	" " " " " females	92

Introduction & aim of the work

INTRODUCTION AND AIM OF WORK

Recently , the use of electronic counter (Coulter Model "S")* gives great reliance for mean corpuscular volume (M C V) determination as it is directly measured (not calculated or computed) with high precision . The conditions with abnormally low M C V values are considered to be of great practical importance due to its clinical implication and this significant finding demands further investigations . This has resulted in a revival of interest in screening the Egyptian population for the incidence of microcytosis and assessment of the prevalence of the non anemic microcytic cases .

Ramzy , S. , (1981) observed high incidence (7.1 %) of Egyptians with low M C V and normal hemoglobin , termed them compensated microcytosis , 63.3 % of them evidenced to be B - thalassemia traits . This high incidence of traits pose a public health problem and the importance of pre - marital diagnosis and counseling is necessary for eugenic

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* COULTRONICS FRANCE S . A .
Margency , France

point of view (as B - thalassemia major is inherited by heterozygous parents) . Her study also revealed the most useful conclusion that taking M C V (measured by electronic counter) as a valid , rapid , screening test for B - thalassemia trait can be used easily in surveys .

These findings attracted the attention to do a retrospective study of cases registered randomly during routine daily work along the last five years to assess the prevalence of the non anemic microcytic cases among the Egyptian population .

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Review of Literature

THE RED CELL

ERYTHROPOIESIS Fig . (1)

Stephenson et al , (1971) considered both BFU - E (burst forming units erythrocytes) and CFU - E (colony forming units erythrocytes) as the earlier progenitors for the identified stage of erythron .

When fetal marrow cells are incubated in plasma clots containing erythropoietin , 8 - 16 cells colonies are developed after 2 days incubation . These colonies consist of erythroblasts or erythrocytes . Axelrad et al ., (1973) noticed that in case of increased erythropoietin concentration and prolonged incubation, the small colonies occured in bursts , so the operational nomenclature used for this system ; the progenitors of the small colonies were called erythropoietin dependent colony forming units or CFU - E and progenitors of the bursts , erythropoietin - dependent burst forming units or

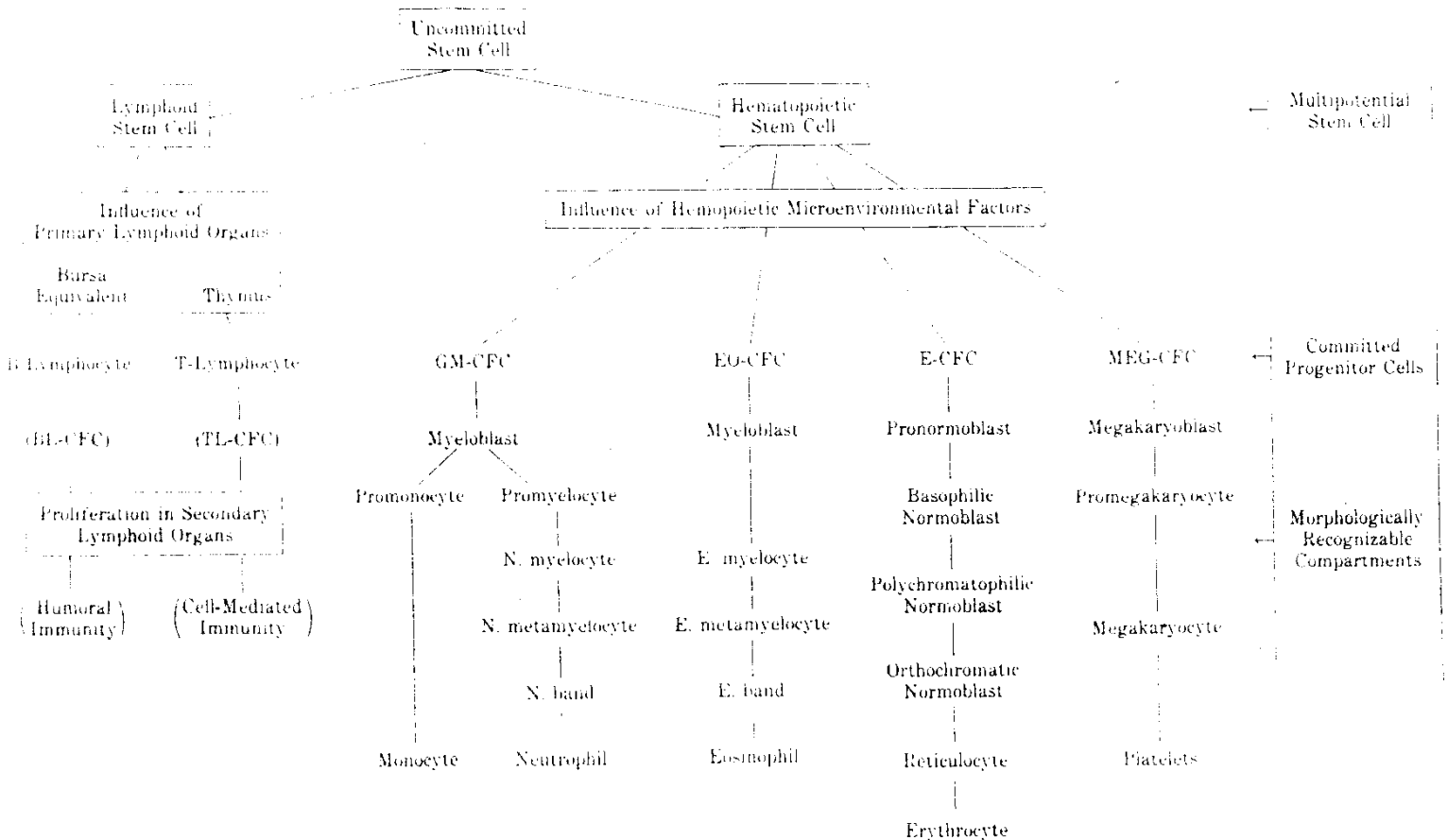

Figure 1. Hypothetical scheme of hematopoiesis as discussed in text. Local or short-range factors for "influences") act on the multipotential stem cells to produce committed progenitor cells.

GM-CFC = granulocyte-monocyte colony forming cell
EO-CFC = eosinophil colony forming cell
E-CFC = erythrocyte colony forming cell
MEG-CFC = megakaryocyte colony forming cell
BL-CFC = B-lymphocyte colony forming cell
TL-CFC = T-lymphocyte colony forming cell

Though lymphocytes can be induced to grow in colonies, these CFC's are not analogous to the committed progenitor cells of the myeloid lines. The latter respond to specific stimulators (e.g. erythropoietin for E-CFC, GM-CSF for GM-CFC) by proliferation and differentiation into mature cells of the particular series.

(Douglas A . Nelson , M.D. 1980).

BFU - E.

Gregory (1976) stated that BFU - E is placed before CFU - E which is more differentiated . Erythropoietin is the monitor of the whole process .

A single stem cell gives rise to 16 mature daughter cells . During the process of maturation there is small loss of cells which are prematurely destroyed in . the bone marrow . There is a gradual reduction in the cell size with a concomitant condensation of nuclear material during development (De Gruchy , 1978) . After the late normoblast stage , the nucleus becomes pyknotic and is extruded from the cell . Following this , there is a variable amount of residual ribonucleic acid (RNA) in the cell .

The predominant cell is the primitive erythroblast, a large cell 15 to 25 u in diameter , with coarse , clumped chromatin in the nucleus , several nucleoli and homogenous basophilic cytoplasm . Since these primitive

erythroblasts differentiation by elaborating a primitive hemoglobin , they probably serve the oxygen needs of the embryo for some time before being replaced by definitive normoblastic cells .

In yolk sac of the 9 weeks old embryo about one half of the cells are primitive erythroblasts and the rest are definitive erythroblasts . Primitive erythroblasts appear very early , elaborate some hemoglobin , and they die being replaced by normoblastic cells that do differentiate into adult erythrocytes .

Rosenberg (1969) studied an 11 weeks old fetus and found that the hemoglobin in liver consisted of 37 % Hb . A and 63 % Hb . F, the peripheral blood of the same foetus contained about 4 % Hb . A and 96 % Hb . F . It would seem that the definitive normoblasts are active in the synthesis of Hb . A even though relatively few of the derivative erythrocytes are released into the peripheral blood at the same time .

RED CELL MORPHOLOGY

The normal circulating erythrocyte is a biconcave or uniconcave discoid cell . The factors necessary to maintain this form are unknown . Variations in the dimensions of the red cell can be of use in the differential diagnosis of anemias .

Normal human red cells have a diameter of 7.2 ± 0.5 um , which decreases slightly with age , (Price-Jones, 1933). They are 1.7 um thick (Houchin et al., 1958) , and have an average volume of 85 um^3 with a surface area of 145 um^2 , (Westerman et al., 1961) .

In the stained film of normal blood , the erythrocyte stains reddish brown with Wright's stain and pink with Giemsa stain . The centre of the cell is relatively clear with peripheral distribution of the stained portion of the cell , reflecting the biconcave disc shape. Red cells on dried blood films are 0.6 um thick , having lost about two - thirds of their normal thickness (Bessis et al., 1970, 73).

Elaboration of hemoglobin is a special feature of the erythroid cells . At first the immature cell has no hemoglobin , gradually a little appears and then a great deal , the most mature normal cell containing a standard and maximal amount of the respiratory pigment . At this stage of development the nucleus is apparently no longer necessary and is eleminated by extrusion .

Normally, the reticulocytes remain in the marrow pool for 1 - 2 days where further maturation occurs , red cells are released as reticulocytes and , since approximately 1 % of the red cell mass is replaced each day, The normal reticulocytic count is about 0.2 - 2 % (Dacie, 1977). In normal adults the number of red cells in the peripheral blood varies from 4.500.000 to 6.500.000 / c.mm (Dacie , 1977) .

The quantitative and qualitative abnormalities found in the peripheral blood are the result of imbalance between cell production , cell release , (which is poorly