



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكرو فيلم

بسم الله الرحمن الرحيم



HANAA ALY



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم



شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



HANAA ALY



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



HANAA ALY



Serum Erythroferrone in End Stage Renal Disease Patients; Relation to Iron Status, Anemia and Erythropoiesis Stimulating Agents

A Thesis

*Submitted for partial Fulfillment of Master Degree
in Clinical Pathology*

Presented By

Aya-t Allah Mohamad Mahmoud Abdelghany

M.B.B.Ch.

Faculty of Medicine, Ain Shams University

Under Supervision of

Prof. Dr. Amal Abd-El-Hamid Mohamad

Professor of Clinical Pathology

Faculty of Medicine, Ain Shams University

Prof. Dr. Hayam Ahmed Hebah

Professor of Internal Medicine and Nephrology

Faculty of Medicine, Ain Shams University

Assist. Prof. Dr. Dalia Ahmed Diaa ElDine Salem

Assist. Professor of Clinical Pathology

Faculty of Medicine, Ain Shams University

*Faculty of Medicine
Ain Shams University*

2021

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

سببنا نك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgment

*First and foremost, I feel always indebted to **ALLAH**, the Most Kind and Most Merciful.*

*I'd like to express my respectful thanks and profound gratitude to **Prof. Dr. Amal Abd-El-Hamid Mohamad**, Professor of Clinical Pathology - Faculty of Medicine- Ain Shams University for her keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

*I am also delighted to express my deepest gratitude and thanks to **Dr. Dalia Ahmed Diaa ElDine Salem**, Assistant Professor of Clinical Pathology, Faculty of Medicine, Ain Shams University, for her kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

*I am deeply thankful to **Prof. Dr. Hayam Ahmed Hebah**, Professor of Internal Medicine, Faculty of Medicine, Ain Shams University, for her great help, active participation and guidance.*

*Last but not least, I dedicate this work to **my family** and **friends** whom without their sincere emotional support, pushing me forward this work would not have ever been completed.*

I would like to express my hearty thanks to all my family for their support till this work was completed.

Last but not least my sincere thanks and appreciation to all patients participated in this study.

Aya-t Allah Mohamad Mahmoud Abdelghany

List of Contents

Title	Page No.
List of Tables	i
List of Figures	iii
List of Abbreviations	vii
Introduction.....	1
Aim of the Work	3
Review of Literature:	
Anemia in CKD	4
Erythropoietin and iron regulation.....	22
Erythrferone in CKD	40
Subjects and Methods.....	47
Results.....	53
Discussion	91
Summary	97
Conclusion	99
Recommendations.....	100
References.....	101
Arabic Summary.....	

List of Tables

Table No.	Title	Page No.
Table (1):	Global prevalence of anemia.....	5
Table (2):	Prevalence of anemia in Egypt.....	6
Table (3):	Underlying causes of ACD	6
Table (4):	Features of anemia of inflammation.	13
Table (5):	Description of demographic, clinical and laboratory data of all patients.	54
Table (6):	Description of demographic data of control group.....	56
Table (7):	Comparison between both control and patients groups according to the demographic data.	56
Table (8):	Comparison between control and all patients according to baseline Erythroferrone level.	57
Table (9):	Comparison between control and both patients subgroups according to baseline Erythroferrone level.....	57
Table (10):	Comparison between control group and all patients according to the post-treatment Erythroferrone level.	59
Table (11):	Comparison between control group and patients subgroups according to the post-treatment Erythroferrone level.	59
Table (12):	Comparison between baseline and post-treatment according to laboratory data in all patients.....	61
Table (13):	Comparison between patients' subgroups as regards the demographic, clinical and baseline laboratory data.	65
Table (14):	Comparison between patients' subgroups as regards post-treatment laboratory data.	68
Table (15):	Comparison between both patients' subgroups (subgroup 1 and subgroup 2) as regards delta change in laboratory data:	72

List of Tables *(Cont...)*

Table No.	Title	Page No.
Table (16):	Comparison between baseline and post-treatment according to laboratory data in subgroup 1(treatment with iron and erythropoietin).....	74
Table (17):	Comparison between baseline and post treatment according to laboratory data in subgroup 2 (treatment with iron only):	78
Table (18):	Erythroferrone correlation with demographic and laboratory data in all patients at baseline and post treatment:.....	82
Table (19):	Erythroferrone correlation with demographic and laboratory data in subgroup 1 at baseline and post treatment.	84
Table (20):	Erythroferrone (ng/L) correlation with demographic and laboratory data in subgroup 2 at baseline and post treatment.	86
Table (21):	Comparison between HCV positive and HCV negative patients according to Erythroferrone level in subgroup 1.....	88
Table (22):	Comparison between hypertensive and non-hypertensive patients according to Erythroferrone in subgroup 1:.....	88
Table (23):	Comparison between diabetic and non-diabetic according to Erythroferrone in subgroup 1.	89
Table (24):	Comparison between HCV positive and HCV negative according to Erythroferrone in subgroup 2.	89
Table (25):	Comparison between hypertensive and non-hypertensive according to Erythroferrone in subgroup 2:.....	90
Table (26):	Comparison between diabetic and non-diabetic according to Erythroferrone in subgroup 2:	90

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Erythropoietin is essential for terminal maturation of erythrocytes.	9
Figure (2):	Erythropoietin Dependent and Iron Dependent Erythropoiesis.....	10
Figure (3):	Distribution of iron in the adult human body and regulation of iron traffic.	17
Figure (4):	Biological structure of EPO.....	24
Figure (5):	Scheme of erythropoiesis.	26
Figure (6):	Control of EPO production. HIF2 α , hypoxia-inducible factor 2 α ; HIF β , hypoxia-inducible factor β ; PDHs, O ₂ and iron-dependent HIF prolyl-4-hydroxylases; UQ, ubiquitin; CBP, CREB-binding protein; EPO, erythropoietin	27
Figure (7):	Iron recycling via the reticuloendothelial system. Approximate proportion of body iron stores in each system are indicated in parentheses.....	37
Figure (8):	Erythroferrone in systemic iron homeostasis	41
Figure (9):	Risk factors distribution among patients group.....	55
Figure (10):	Comparison between control and all patients according to baseline Erythroferrone level.....	58
Figure (11):	Comparison between control and both patients subgroups according to baseline Erythroferrone level:	58
Figure (12):	Comparison between control group and all patients according to the post-treatment Erythroferrone level (ng/L)	60
Figure (13):	Erythroferrone level (ng/L) comparison between control and both patient subgroups post-treatment.	60
Figure (14):	Comparison between baseline and post treatment according to Hb(g/dl) in all patients.....	62
Figure (15):	Comparison between baseline and post treatment according to HCT% in all patients.	62
Figure (16):	Comparison between baseline and post treatment according to S.iron(μ g/dl) in all patients.	63

List of Figures *(Cont...)*

Fig. No.	Title	Page No.
Figure (17):	Comparison between baseline and post treatment according to TIBC($\mu\text{g/dl}$) in all patients.....	63
Figure (18):	Comparison between baseline and post treatment according to TSAT% in all patients.	64
Figure (19):	Comparison between baseline and post-treatment according to Erythroferrone(ng/L) in all patients.....	64
Figure (20):	Comparison between subgroup 1 and subgroup 2 according to baseline Hb(g/dl).	66
Figure (21):	Comparison between subgroup 1 and subgroup 2 according to baseline HCT%.....	67
Figure (22):	Comparison between subgroup 1 and subgroup 2: according to baseline Erythroferrone (ng/L).	67
Figure (23):	Comparison between subgroup 1 and subgroup 2 according to post treatment Hb(g/dl).....	69
Figure (24):	Comparison between subgroup 1 and subgroup 2 according to post treatment HCT%.	70
Figure (25):	Comparison between subgroup 1 and subgroup 2 according to post treatment TIBC($\mu\text{g/dl}$).	70
Figure (26):	Comparison between subgroup 1 and subgroup 2 according to post Erythroferrone (ng/L).....	71
Figure (27):	Comparison between subgroup 1 and subgroup 2 according to delta change between baseline and post-treatment in Erythroferrone level (ng/L).	73
Figure (28):	Comparison between baseline and post treatment according to Hb (g/dl) in subgroup 1.	75
Figure (29):	Comparison between baseline and post treatment according to HCT% in subgroup 1.....	75
Figure (30):	Comparison between baseline and post treatment according to Serum Iron ($\mu\text{g/dl}$) in subgroup 1.	76
Figure (31):	Comparison between baseline and post treatment according to TIBC ($\mu\text{g/dl}$) in subgroup 1.	76