BLOOD VISCOSITY AND HEMATOLOGIC DISORDERS

ESSAY

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By

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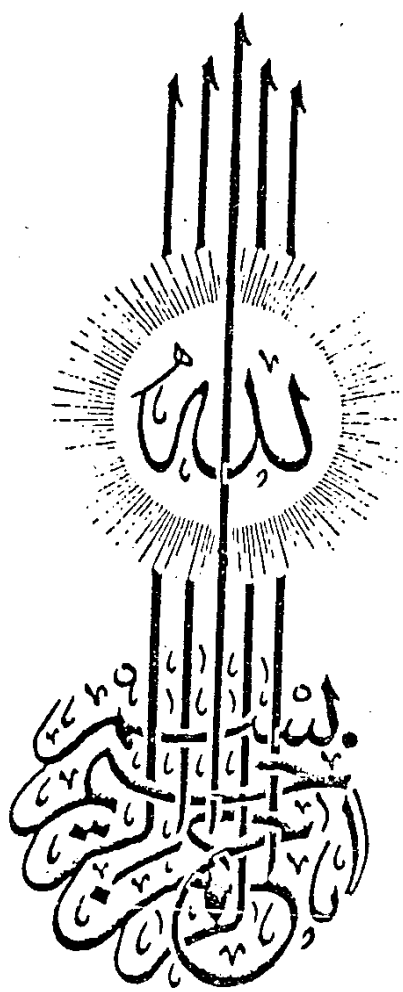

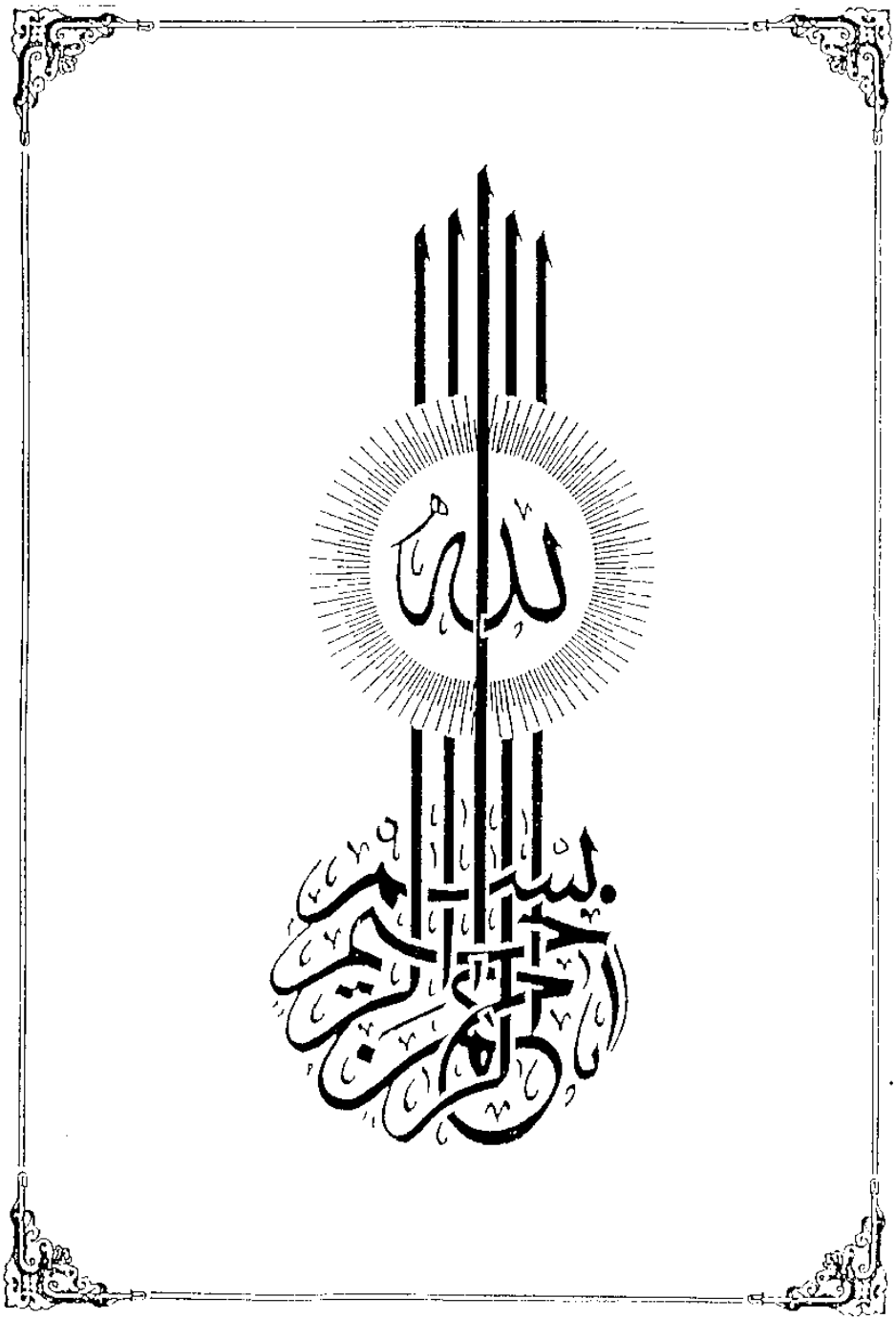

TO MY PARENTS AND MY DAUGHTER, NADA
FOR THEIR CONTINUOUS ENCOURAGMENT AND LOVE

ACKNOWLEDGEMENT

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INTRODUCTION

Introduction

The role of blood viscosity in clinical haemorheology had been thoroughly studied during the past years for its significance and effectiveness. Several factors have been introduced, influencing whole blood viscosity among which are the haematocrit ratio, red cell deformability, plasma and its constituents and the shear rate. Plasma viscosity is assumed to be an important factor that influence blood viscosity, and it is directly correlated to the concentration of large sized molecules especially proteins. What is of interest is that different disorders can be described by profiles of viscosity factors, which form a rheological fingerprint specific to a particular disease or group of disorders. This stimulated us to review the factors affecting blood viscosity and the role of blood viscosity in the pathogenesis of haematologic disorders and ischaemic heart diseases. Supplementing these information special references to the different methods used for measuring blood and plasma viscosity will be mentioned taking into consideration the

suitable working one, as regards, volume of sample, duration, accuracy and operative simplicity.....etc.

Aims of the essay:

1) To review the literature about the various factors affecting blood viscosity.

2) To find correlation between ischaemic heart disease and the changes in blood viscosity.

3) To detect a relation between blood viscosity, hyperviscosity syndrome and concentration of paraprotein.

4) Summation of the various methods used for measuring the blood viscosity.

REVIEW OF LITERATURE

Historical Background:

The credit for first describing the hemodynamics importance of blood viscosity goes to **Stephen Holes** at the beginning of the 18th century. He observed that the resistance which the blood meets within the capillary passages may be greatly varied,either,by different degrees of viscosity,or,fluidity of blood or,the several degrees of constriction or relaxation of these fine vessels.The quantitative investigation of the part played by viscosity in blood flow had to wait another century till **Poiseuille** performed his careful experiments on the flow of fluids through narrow tubes.The result was **Poiseuille's** formula which relates flow directly to the driving preessure,the radius of the vessel and inversly to the viscosity.Indeed the modern unit of viscosity is called **Poise** after him.

Beingham (1929) has defined viscosity as the property of a rheological material to resist flow,and described rheology as the science of deformation and flow of all matters.

Wayland,(1965),out of this extremely broad definition the

term is usually referred to mechanics of non-newtonian fluids as a solid viscoelastic material.Later,in 1967 **Meiselman** tried to explain the original conceptualization by **Newton** in an experiment based upon a newtonian fluid,as water,it is one in which the ratio shear stress/shear rate is constant.This ratio is defined as the viscosity.

Such newtonian fluids are said to obey **Poiseuille's** law and have a definite coefficient of viscosity independant of the condition of measurement. In relation to blood, a non-newtonian fluid which does not obey that law, the viscosity is not a simple and easily defined concept.

Meanwhile many authors,**Wells**and**Merril** (1961),**Dintefass** (1964), **Wayland** (1965)and**Meisselman** (1967), have shown that although blood at very high flow rates is newtonian (i.e.the viscosity is independant of flow rate),it takes on quite special non newtonian characteristics as its flow rate decreased.The most important character being that as the rate of flow diminishes till it reaches zero the force of resistance decreases not to zero but to a definite value.This residual force of resistance at

zero flow rate is called the yield shear stress.Numerous industrial fluids are designed to have a yield shear stress e.g.house paint must have a certain yield shear stress to resist flow by gravitational forces after application to a vertical surface.In human blood,the yield shear stress is the consequence of a reversible aggregation of red cells promoted by non activated (native) fibrinogen (**Merril et al.,1963**)

Dormandy(1970) defined viscosity as the measure of fluid friction and can be considered as the result when a layer of fluid is made to move in relationship to another layer.

FACTORS AFFECTING BLOOD VISCOSITY