

EFFECT of ANAESTHESIA
AND SURGERY ON REGIONAL
CIRCULATION

CEREBRAL
CORONARY
HEPATIC
RENAL

THESIS

Submitted in Partial Fulfillment
for the Master Degree in
ANAESTHESIOLOGY

By

BAHAA - AL-DIN EWIESS

M. B., B. CH.

Supervised by

Dr. SALAH AL-HALABY

Professor of Anaesthesiology
Ain Shams University

Dr. MAHMOUD SHERIF

Assist. Professor of Anaesthesiology
Ain Shams University

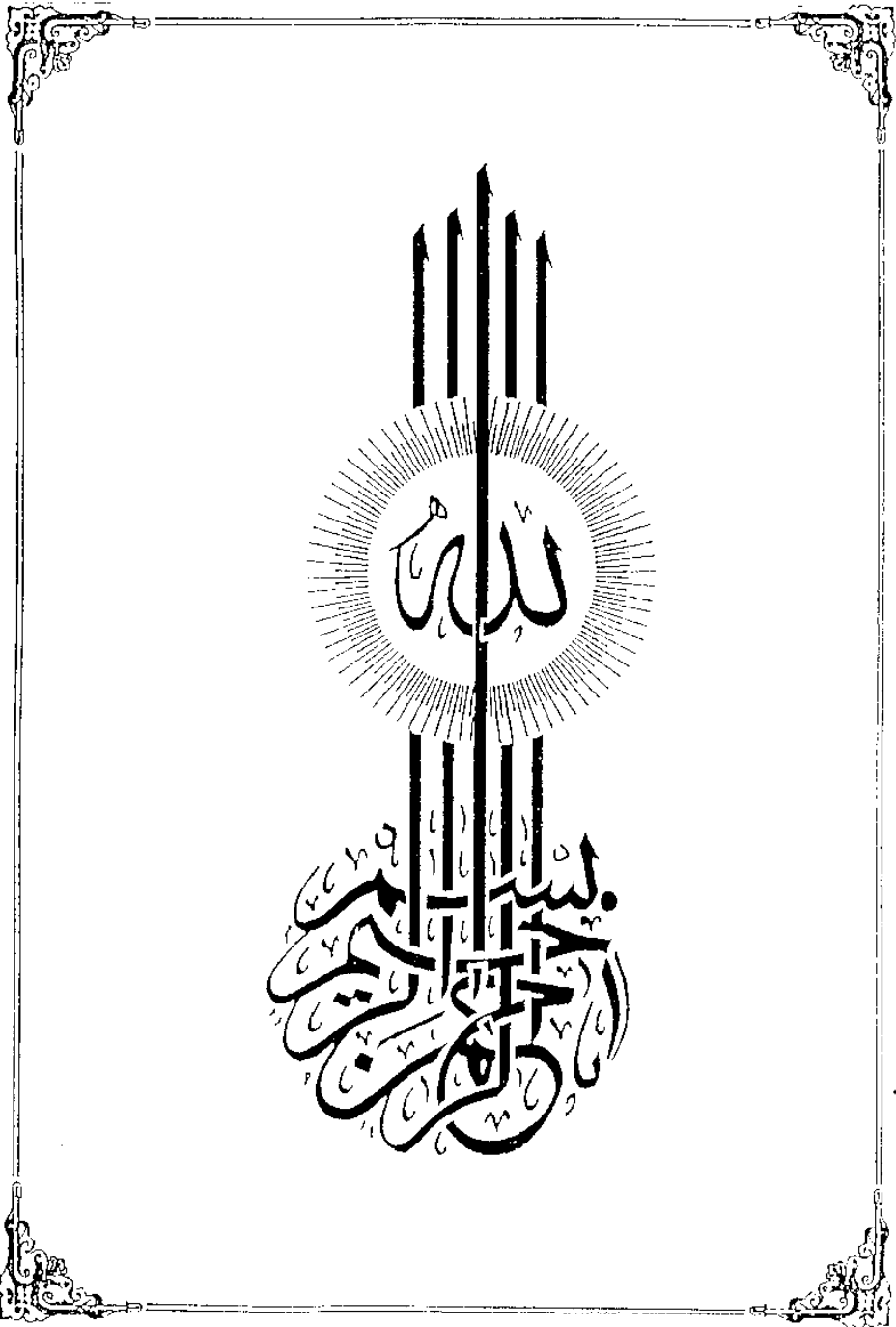
FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY

1986

ACKNOWLEDGEMENT

I would like to express my deepest appreciation and utmost gratitude to Dr. Salah Al. Halaby Professor of Anaesthesiology, Faculty of Medicine, Ain Shams University for his kind supervision, valuable guidance, and fruitful suggestion and inspiration to this work. I'm sincerely thanks to Dr. Mahmoud Sherif Assist. Professor of Anaesthesiology, Faculty of Medicine, Ain Shams University, for hies continuous encouragement, tremendous effort and valuable cooperation throughout the work.

To all who kindly gave me encouragement and advice in this work, I pay much gratitude.



DEDICATION

TO MY PARENTS AND WIFE.

CONTENTS

	Page
Introduction.	1 - 2
Anatomy of Cerebral Circulation.	3 - 9
Anatomy of Coronary Circulation	10 - 16
Anatomy of Hepatic Circulation.	17 - 23
Anatomy of Renal Circulation.	24 - 27
Physiology of Cerebral Circulation.	28 - 41
Physiology of Coronary Circulation.	42 - 59
Physiology of Hepatic Circulation.	60 - 67
Physiology of Renal Circulation.	85 - 88
Measurement of Cerebral Circulation.	89 - 92
Measurement of Coronary Circulation.	93 - 96
Measurement of Hepatic Circulation.	97 - 101
Measurement of Renal Circulation.	102 - 104
Effect of Anaesthesia and Surgery on Cerebral Circulation.	105 - 126
Effect of Anaesthesia and Surgery on Coronary Circulation.	127 - 146
Effect of Anaesthesia and Surgery on Hepatic Circulation.	147 - 165
Effect of Anaesthesia and Surgery on Renal Circulation.	175 - 177
Refereneces.	178 - 203

INTRODUCTION

INTRODUCTION

Although all components of the cardiovascular system participate in the transport and distribution of the blood to and from the different organs and tissues, these activities are usually considered to be a function primarily of the peripheral circulation. The heart in this system essentially serves as a pressure-force generator, keeping the blood in continuous motion at constant pressure but relatively indiscriminating role in regulation of blood flow.

For this reason most of the recent research in regional blood flow has focused on peripheral vascular apparatus. Function of peripheral circulation are accomplished by changes of vascular smooth muscle tone in the different types of blood vessels and in different regional beds.

In fact the tone of vascular smooth muscle cells seems to be the single most important determinant of regional blood flow and local tissue nutrition.

Therefore, the responsiveness of vascular muscle elements to drugs given for a wide variety

of therapeutic purposes including anaesthetic agents has become a mother of intense interest since those action often condition the safe use of such drugs. Similarly, the peripheral vasomotor responses to a whole spectrum of stress situation which can develop during the course of anaesthesia and operation hypoxia, hypovolaemia, body temperature change, shock...etc, because they impair tissue blood flow, have been the subject of much recent research effort.

So the knowledge about regional circulation is important to anaesthesiologic practice to be able to modify peripheral vascular behaviour in many clinical situations sufficiently to prevent or correct inappropriate or low-flow states.

ANATOMICAL
CONSIDERATION

ANATOMICAL CONSIDERATION OF CEREBRAL CIRCULATION. -----

The arterial supply of the brain is derived from the internal carotid and vertebral arteries on each side, two-thirds of the supply coming from the carotid system.

The arteries are directed in essence to the grey matter, which needs more blood supply than the white matter.

Superficial cortical arteries supply the grey matter on the surface, perforating arteries supply the grey matter of the basal ganglia, both sets of arteries send branches to the adjacent white matter.

An artery which has entered the surface of the brain from either of these sets is always an end artery.

The internal carotid arteries and vertebral arteries (that arise from subclavian arteries) anastomose with each other around the

optic chiasma and infundibulum of pituitary stalk, forming the circle of Willis.

The communicating vessels are small and in many cases are inadequate to maintain an effective circulation of one carotid artery if suddenly blocked (Symon, 1967).

Circle of Willis:

The circle of Willis is formed in the following ways: The basilar artery (from union of both vertebral arteries) divides in the upper border of the pons into right and left posterior cerebral arteries. From each posterior cerebral artery, a small posterior communicating artery runs forward through the interpeduncular cistern to join the internal carotid artery at the anterior perforating substance. Each internal carotid artery gives off an anterior cerebral artery, the circle of Willis is completed by the anterior communicating artery, a small vessel that unites the anterior cerebral arteries in cisterna chiasmatica.

The only structures encircled by the circle of willis are optice chisma and pituitary stalk.

The arterial supply of the cerebral cortex is by these three cerebral arteries. Anterior, middle, and posterior cerebral artery.

Internal Carotid Artery:

The left one arises from the aorta but the right one arises from the innominte artery.

It devides in to two branches, in the anterior perforated substance, for arterial supply of the cerebral cortex-as it gives anterior and middle cerebral arteries.

The Middle Cerebral Artery:

Is the, largest and most direct branch of the internal carotid artery and therefore the most subject to embolism. It passes deep in to the lateral fissure to supply the cortex of the insula and overlying opercula. It reaches the the lateral surface of the hemisphere by passing in the lateral fissure.

In its area of cortical distribution lie the motor and sensory area of the apposite half of the body excluding leg and perineum.

Anterior Cerebral Artery:

Leaves the internal carotid artery at the anterior perforated substance and passes forward above the optic nerve.

It is distributed to the orbital surface of the frontal lobe and to the whole of the medial surface of the hemisphere above the corpus callosum as far back as the parieto-occipital sulcus. Its distribution extends over the superior border to meet the area supplied by the middle cerebral artery. The motor and sensory area of leg and perineum lie in its distribution.

The Posterior Cerebral Artery:

It arises from the vertebral artery supplying the inferomedial surface of the temporal lobes and occipital lobes. Its territories meet that of anterior cerebral artery

at the parieto-occipital sulcus. The visual area of the opposite side lies wholly within its territory.

Venous Drainage:

The venous return does not follow the arterial pattern. Unlike the cortical arteries, which tend to travel deep in the sulci, the cortical veins tend to travel superficially, in the arachnoid matter. They lie adherent to the deep surface of the arachnoid matter that bridges each sulcus.

In general blood flows into nearest available venous sinuses of the dura matter, generally entering obliquely against the blood stream.

Adherent to the deep surface of the arachnoid matter that bridges the lateral sulcus, runs the superficial middle cerebral vein, draining the adjacent cortex and emptying in to cavernous sinuses.

At the posterior end of this vein are the superior and inferior anastomotic vein

which join the superior sagittal and transverse sinuses. Blood from this region drains in to the middle cerebral vein' which runs along with artery to join basal vein.

The medial and inferior surface of cerebral hemisphere drain in to the geonetrically nearest venous sinus of the dure matter. Here the blood from the surface at the hemisphere is collected in to the "anterior cerebral vein" which drains also the orbital surface of the frontal lobe.

At the anterior perforated substance striate veins emerg through the perforation and draining the lower part of the corpus striatum and join the deep middle cerebral vein and anterior cerebral vein, the veins from these three sources from the basal vein.

It receives blood from the posterior perforated substance, these drain the lower part of the thalamus. Just below the splenium the two basal veins join the great cerebral vein to enter the straight sinus.