RETINOPATHY OF PREMATURITY

Essay

Submitted For The Partial Fulfillment of the Master Degree of Ophthalmology

By

AMANI RAMSIS FRANCIS
M.B.B.Ch.

Supervised By

Dr. MERVAT SALAH MOURAD
Assistant Professor of Ophthalmology
Ain Shams University

Dr. OSAMA ABD EL-KADER SALEM
Lecturer of Ophthalmology
Ain Shams University

Faculty of Medicine
Ain Shams University

1996

Acknowledgment

First of all, thanks to GOD who gives us the gift of knowledge and understanding.

I would like to express my sincerest gratitude and appreciation to *Dr. Mervat Salah, Assistant Professor of Ophthalmology, Ain Shams University,* for her keen supervision, valuable remarks, unlimited support and guidance throughout the preparation of this work.

I also, wish to thank *Dr. Osama Salem, Lecturer of Ophthalmology, Ain Shams University,* for his constant help, encouragement and unfailing advice, and who has contributed a lot to the delivery of this work.

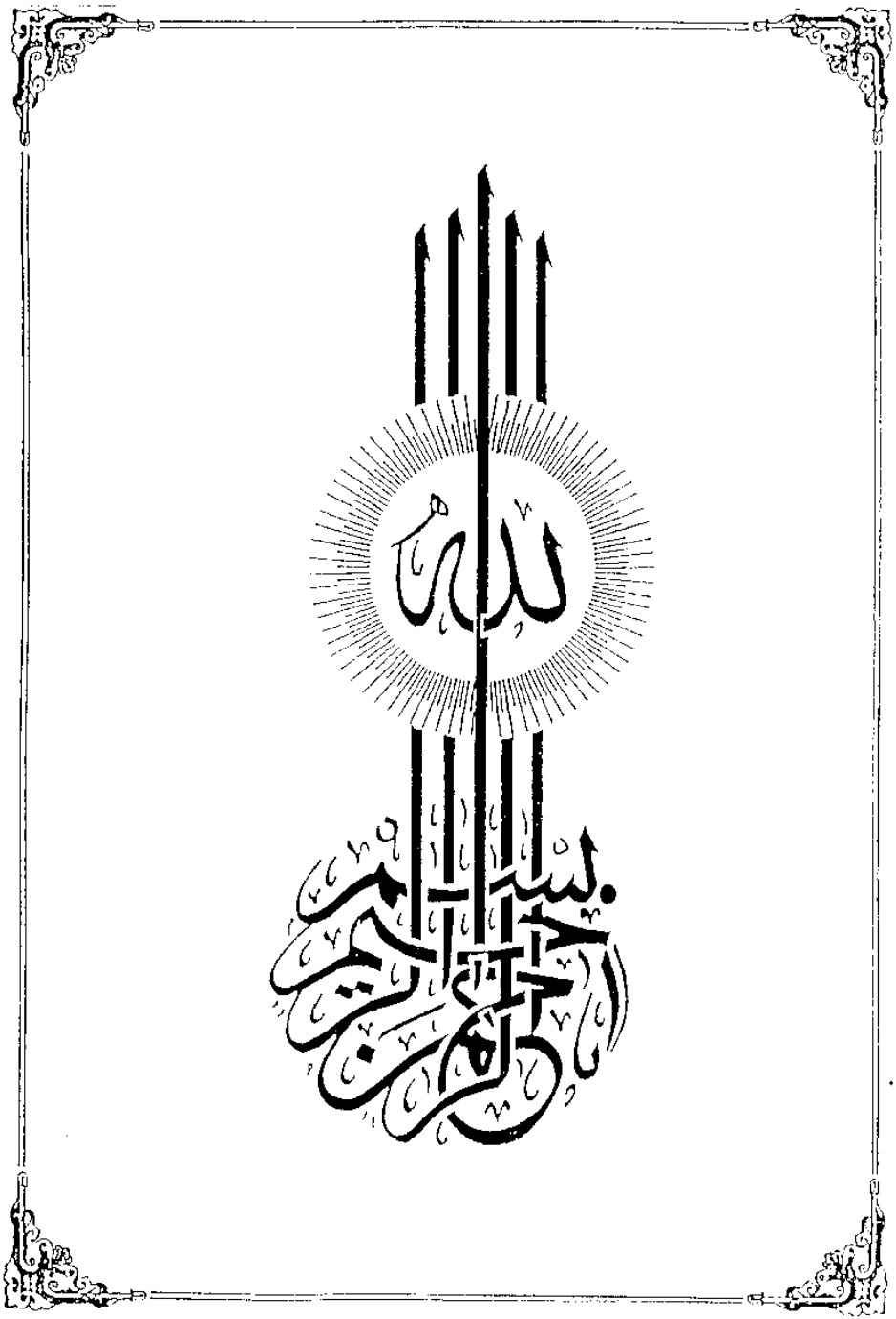

TABLE OF CONTENTS

Introduction & History

AIN SHAMS UNIVERSITY

Introduction And History

Retinopathy of prematurity **(ROP)** is a disorder of developing retinal blood vessels in extremely premature infants that may regress completely or leave a spectrum of sequelae from mild myopia to blindness due to retinal detachments.

ROP develops in premature infants weeks after birth as a sequelae to the earlier injury of immature retinal vessels. In *1940s* and *1950s, Silverman,* estimated that over ten years, about a thousand infants per year developed blindness from ROP, which was named Retrolental Fibroplasia **(RLF),** by *Terry* at that time *(1942).*

Injury to the developing retinal vessels was believed to be caused by "excess" oxygen i.e. more than 50% oxygen for 28 days. Therefore, oxygen was severely restricted and the disease nearly disappeared in the mid 1950s *(Kinsey et al., 1956).* A little or no mention of ROP was made in literature during that time. However, with the development of modern intensive care ventilators, and other technology that resulted in the increased survival of increasingly smaller premature infants, ROP made a come back in the 1970s *(Phelps, 1981).*

During the 1970s and 1980s an increasing incidence of retrolental fibroplasia occurred despite increasingly sophisticated techniques of monitoring blood oxygen level *(Phelps, 1981).*

It was in the 1980s that Retinopathy of Prematurity became accepted as the name for Retrolental Fibroplasia **(RLF)** a term that has now been discarded. The term (ROP) is preferred because it can be utilized to describe all phases of retinal changes, unlike

Introduction And History

Retinopathy of prematurity **(ROP)** is a disorder of developing retinal blood vessels in extremely premature infants that may regress completely or leave a spectrum of sequelae from mild myopia to blindness due to retinal detachments.

ROP develops in premature infants weeks after birth as a sequelae to the earlier injury of immature retinal vessels. In *1940s* and *1950s, Silverman,* estimated that over ten years, about a thousand infants per year developed blindness from ROP, which was named Retrolental Fibroplasia **(RLF),** by *Terry* at that time *(1942).*

Injury to the developing retinal vessels was believed to be caused by "excess" oxygen i.e. more than 50% oxygen for 28 days. Therefore, oxygen was severely restricted and the disease nearly disappeared in the mid 1950s *(Kinsey et al., 1956).* A little or no mention of ROP was made in literature during that time. However, with the development of modern intensive care ventilators, and other technology that resulted in the increased survival of increasingly smaller premature infants, ROP made a come back in the 1970s *(Phelps, 1981).*

During the 1970s and 1980s an increasing incidence of retrolental fibroplasia occurred despite increasingly sophisticated techniques of monitoring blood oxygen level *(Phelps, 1981).*

It was in the 1980s that Retinopathy of Prematurity became accepted as the name for Retrolental Fibroplasia **(RLF)** a term that has now been discarded. The term (ROP) is preferred because it can be utilized to describe all phases of retinal changes, unlike

the traditional term RLF which describe solely the later cicatricial changes *(Phelps, 1993).*

Development of the Eye

Development and Anatomy of the Retina

Development of the Eye:

The formation of the eye begins at about the 22nd. day of fetal life in human. During the next 6 to 8 weeks, development is nearly complete. The eye begins as a neuroectodermal invagination of the forebrain. Optic vesicle formation is accomplished by the 25th day, by which time the neural tube is completely closed, and the embryo has 20 pairs of somites, and a crown - rump length of about 4 mm. The optic vesicle becomes more clearly defined by the development of a constriction between the vesicle and the remainder of the forebrain. This constriction becomes the optic stalk. (**Fig. 1**).

The central or the most peripheral part of the optic vesicle will develop into the sensory retina and is the first site of cellular differentiation in the eye. The lateral portion will become the epithelium of the non-neural retina i.e. epithelium of the iris and ciliary body. The outermost portion will be the future pigment epithelium. Then the lens placode and the sensory retina invaginate together to form the lens pit and the optic cup. Formation of the optic cup is accompanied by formation of a groove, known as the choroidal fissure, located in the inferonasal area. The edges of the fissure gradually come together but remain open anteriorly which becomes the pupil and posteriorly providing the space through which the hyaloid artery may enter *(McDonnell, 1994).*

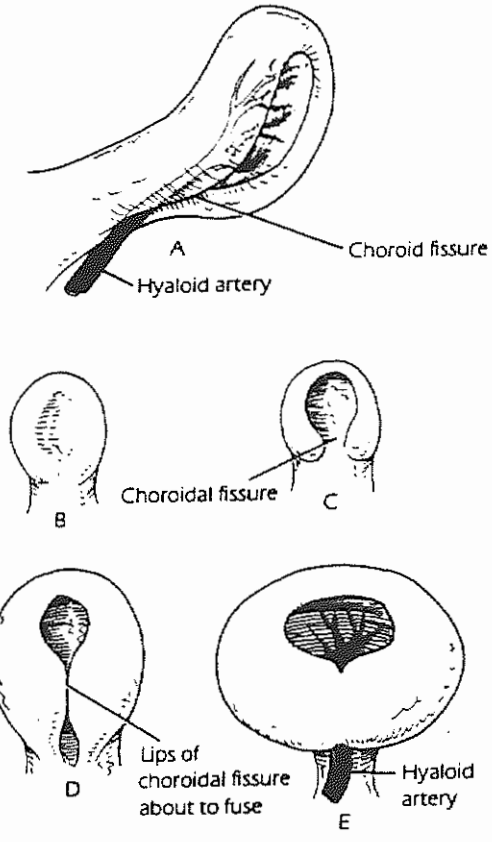

Fig. 1: A, B, C, D, E. A series of diagrams illustrating the formation of the optic cup from the optic vesicle *(Snell and Lemp, 1989).*

Development of the Retinal Blood Vessels:

During the early development, the optic nerve and retina are avascular because the hyaloid system of vessels supplies the developing lens and vitreous only at that time *(Walf, 1976).*

The earliest retinal vascularization provided by the hyaloid artery which is a part of the primary vitreous and is present by the time the choroidal fissure closes, at about 6 weeks' gestation. The

hyaloid artery is a branch of the ophthalmic artery. Two veins parallel the artery to the level of the disc, after which they merge to become the central retinal vein.

By around 16 weeks, intraretinal vessels can be recognized as buds coming off the hyaloid artery, or as collection of cells around it that eventually form lumina and connect with the hyaloid lumina. (**Fig. 2**).

Venous development occurs as buds protrude from the veins that are present at the optic disc. The process of vascular growth within the nerve fiber layer proceeds from the disc outwards, and continues until the end of gestation. The nasal peripheral retinal vascularization is complete at about the ninth month of gestation, and the temporal periphery is completely vascularized within a few weeks after that. The intravitreal hyaloid artery regresses to the disc, where it persists and become the central retinal artery *(McDonnell, 1994).*

The gray appearance of the peripheral retina must not be mistaken with ROP and considered as a normal ocular finding in premature infants *(Kalina, 1979).* (**Fig. 3**).

On a study carried out by *El-Hoshy and Abou El-Ghar, 1974,* of fundus pictures of newly born full term infants, they found that lack of pigmentation is a predominant feature. For this reason the choroidal vessels are distinctly seen in the first month with little pigmentation in the intervascular spaces, moreover, the pigmented epithelium may give a stippled impression occasionally resembling salt and pepper fundus associated with congenital syphilis. The fundus of the premature infant differs also from full term that their optic disc is grayish white in color,

elliptical in the form, with absent foveal reflex, and the peripheral retina shows narrow vessels not reaching the extreme periphery.

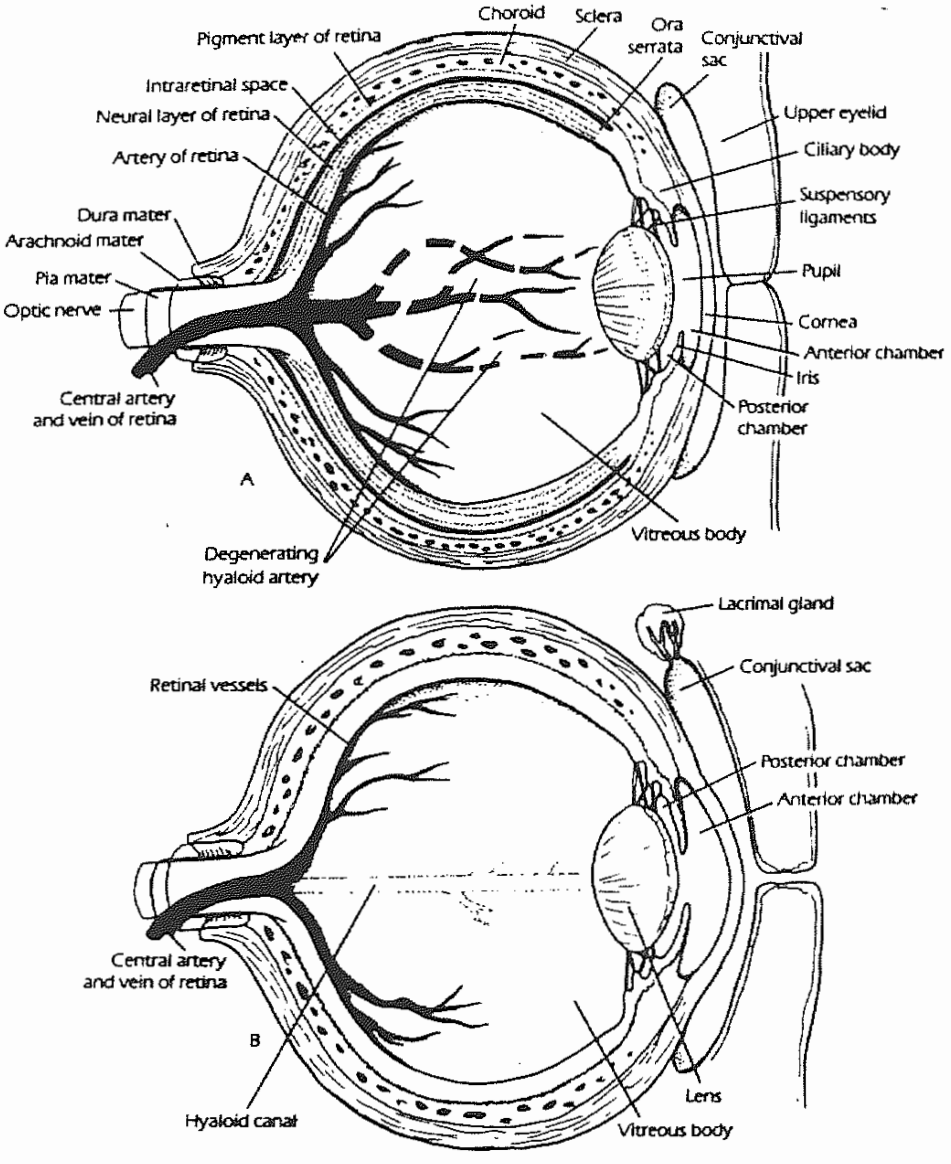

Fig. 2: A & B Show the eye in advanced stages of development *(Snell and Lemp, 1989).*

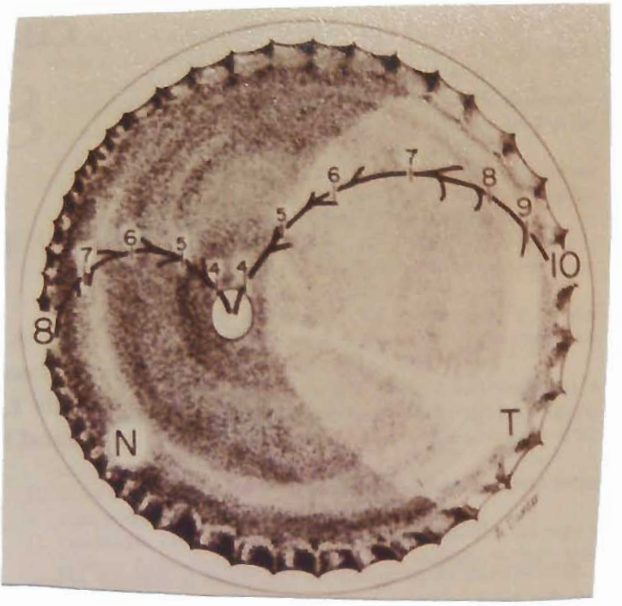

Fig. 3: Schematic diagram of retinal vessels development in man. At 4 months gestation, vessels grow from the disc to reach the ora serrata nasally at 8 months and the ora temporally shortly after that *(Palmer et al., 1994).*

Anatomy of the Retina