COMPARISON BETWEEN THE HISTOLOGY OF NORMAL AND CATARACTOUS LENS

Submitted for partial fulfilment
of the Degree of Master in Histology

By

Dr. Sahar Mahmoud Ahmed Mansour
M.B.B., Ch. (Ain Shams)

SUPERVISED BY

PROF. ABD EL LATIF MOHAMED SALEH
HISTOLOGY DEPT.
FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY

ASS. PROF. SALWA MOHAMED ABD EL TAWAL
HISTOLOGY DEPT.
FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY

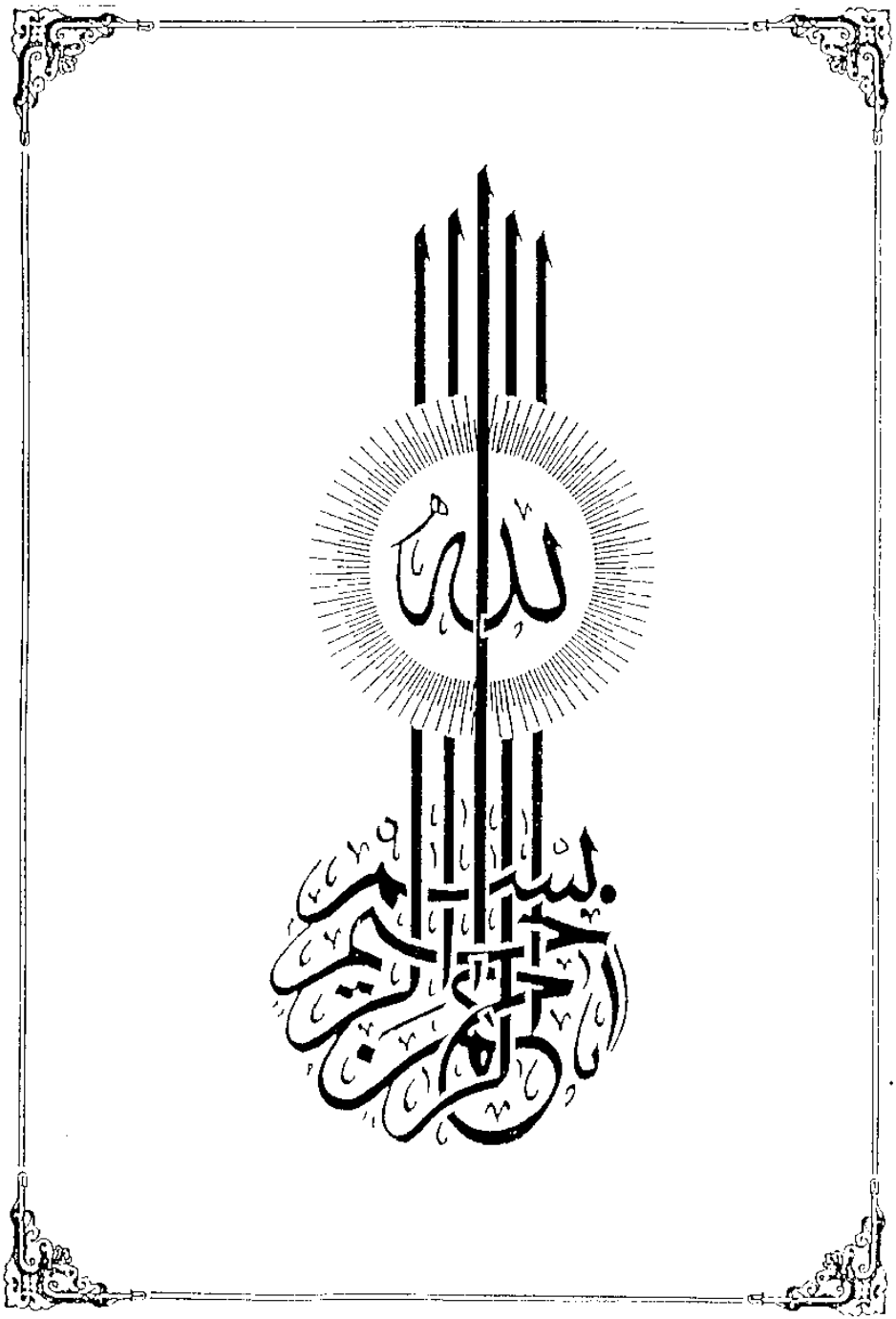
ASS. PROF. LAILA M. RASHAD ABDEL KHALIK
HEAD OF DEPT. OF HISTOPATHOLOGY
AND ELECTRON MICROSCOPY
NATIONAL RESEARCH CENTRE
CAIRO

FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY

1986

CONTENTS

==========



ACKNOWLEDGEMENT

I would like to express my deep gratitude to Dr. Abd El Hatif Saleh, Professor of Histology Ain Shams University for his great help, sincere guidance and continous encourgement and effort through out the work.

Iam deeply indebted to Dr. Salwa Abd El Tawab Ass. Professor, Histology department Ain Shams University for her constant supervision, honest assistance and for her practical and theoretical help.

I wish to express also my deep thanks to Dr. Laila Rashad Ass. Professor of Histopathology and electron microscopy National Research Centre for her critical guidance and valuable advice.

I can't forget to thank Professor Dr. Saiid Moussa, Chairman of Histology Department Ain Shams University for solving all problems and obstacles in a fatherly spirit and giving me access to all facilities in the department.

AIM OF THE WORK

Aim of work

The lens is of a special significance as it is the structure responsible for most of the treatable blindness today in the world.

We must admit that, although the study of the lens is certainly very attractive, it is also distressing because of the over whelming number of structural and functional features that are comprised in such a small and only apparently "simple" suborgan.

The lens is transparant, avascular, biconvex structure held in position behind the pupil by the zonular fibers. Any loss of its transparency is called cataract or lens opacity.

Brisseau, in a communication to the French Academy of Sciences in (1705), was the first who attributed cataract formation to the lens. (Grom, 1975).

It is estimated that 5 - 10 million individuals become visually disabled each year because of cataract (Newell et al., 1978).

The work carried in this research stressed upon comparing the histological picture of normal lenses

taken from cadever eyes with the histological picture of different types of cataractons lenses taken from patients operated upon at the ophthalmic departments in the hospitals.

INTRODUCTION

INTRODUCTION

EMBRYOLOGY OF THE HUMAN LENS:

The earliest embryonic stage at which ocular structures can be differentiated from the rest of the foetus is the embryonic plate stage.

The development of the lens includes four stages which are:

1. lens plate
2. lens pit
3. lens pouch
4. and finally the lens vesicle, (Wolff, 1976)

The lens in the only intraocular structure divided entirely from the surface ectoderm. The basis of the suspensory ligament of the lens arises as a result of the interaction between the surface ectoderm and the neural ectoderm.

At the 4 - 5mm. stage, the surface ectoderm opposite the distal part of the primary optic vesicle thikens and the cells become columnar, actively divide and are become arranged in one larger, known as the lens plate.

A pit appears in it, which deepens into a pouch,

the latter closes forming a vesicle. This vesicle in vaginates the primary optic vesicle forming the optic cup and subsequently the vesicle becomes separated from the surface ectoderm forming an independant structure and this takes place at 9mm. stage (4 weeks). Soon after, at 13 mm. at 17 or 6 weeks stage, the lens becomes a hollow structure and is engaged in Desoxy ribo nucleic acid synthesis (D.N.A.) and mitosis takes place actively throwing the cells into the lens vesicle.

The posterior wall is much thick (being composed of tall columnar cells) than the anterior wall.

The cavity within the lens vesicle is more or less crescent - shaped and eventually it becomes obliterated. The vesicle after becoming detached from the ectoderm moves inwards and gradually assumes a biconcave shape. (Ham et al., 1979).

Stages of growth of embryonic lens from Peyman G.A, Sanders D.R. and Goldberg M.E. (1980). Principles and Practice of ophthalmology W.B. Saunders company, philadelphia / London/Toyonto P: 489.

Differentiaiton of cells into fibers:

The epithelial cells of the lens differentiate into what are termed lens fibers, in this process their nuclei disappear.

Not all the epithelial cells of the lens vesicle differentiate simultaneously but the process occurs in order (Patten, 1968).

The first cells to be differentiated are those of the posterior part of the vesicle, which are derived from the center of the lens plate. They become columnar, elongated to fill the lens vesicle and form **Primary lens fibers.** However, the epithelial cells of the anterior wall of the original lens vesicle which are derived from the periphery of the lens plate, remain intact and they proliferate as shown by the fact that mitotic figures are seen among them easily during foetal development.

The cells at the junction of the anterior and posterior walls, the equator of the lens vesicle, remain immature and produce new fibers, **the secondary lens fibers,** throughout the life of the lens. This process occurs continiously thorughout life. The secondary new fibers surrounded the primary old ones which form the nuclear region of the lens and thus the lens gets its

laminated appearance. (Maisel H. et al., 1981)

Sutures start to appear at the second month. At first the lens fibers end in a vertical suture anteriorly and a horizontal one posteriorly. Later, these become Y-shaped vertical anteriorly and inverted posteriorly. Fibers formed in adult life start and end in more complicated stellate figures. (Kusazak et al., 1984).

The lens capsule is secreted by the lens epithelium at 13 mm. stage embryo. (Wolf, E 1976). Another view is that the capsule is ectodermal in origin and develops as a result of thickening of that portion of the surface ectoderm which is destined to form the lens vesicle and is necessarily carried on with it as it becomes invaginated. (Jakobiec, 1982)

Tunica vasculosa Lentis

The tunica vasculosa lentis beocmes evident in the 13 mm. stage embryo.

Buds from the hyaloid vessels develop into capillaries which anastomose, producing a vascular net over the posterior surface of the lens. The hyaloid artery as it approaches the lens divides into 3 branches roughly forming a Y figure formed of inferior set and two lateral sets which emerge between the edges of optic cup

and the lens equator, these lateral branches anastomose with the annular vessels at the margin of the cup, to form the lateral or capsulo-pupillary part of the tunica.

Also, lateral branches anastomose with the long posterior ciliary arteries at the anterior or pupillary portion of the tunica.

The vascular capsule disappears at or just before birth, except remnants of the hyaloid vessels (arc line), and pupillary remnants which persist in 25% of cases.

Many anomalies arise from the persistance of parts of the vascular sheath. (Badr. S.H., 1977).

Important stages in the development of the human lens (Jakobiec 1982):

Description of developmental event	Embryo length	Approximate age
- Lens thickening appears.	4 mm	2 weeks
- Lens pit formed.	5 mm	2 weeks
- Lens vesicle formed.	7 mm	4 weeks
- Lens vesicle separated.	10 mm	4 weeks
- Primary lens fibers.	12 mm	5 weeks
- Lens capsule, deep layer forming.	13 mm	5 weeks
- Secondary lens fibers begining.	25 mm	7 weeks
- Y sutures recoguizable.	35 mm	8 weeks
- Vascular capsule fully developed.	40 mm	9 weeks
- Zonular lamella of capsule forming.	70 mm	3 months
- Retrogression of posterior vascular capsule begins.	110 mm	4 months
- Retrogression of capsulo-pupillary vessels.	110 mm	4 months
- Retrogression of pupillary membrane.	250 mm	6 months
- Complete retrogression of vascular capsule.		Birth
- Adult nucleus and cortex from.		Throughout the remainder of life.