Correlation between Choroidal Thickness using Enhanced Depth Imaging OCT and Visual Acuity in Dry Type AMD in Egyptian Population

Thesis

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Ahmed Ali Ibrahim Metwally

List of Contents

List of Tables

List of Figures

List of Figures *cont...*

List of Abbreviations

Abb.	Full term

AMD.....*Age Related Macular Dengeration*

VA……*Visual Acuity*

BCVA .....*Best corrected visual acuity*

EDI-OCT.....*Enhanced depth imaging-optical coherence tomography*

OCT.....*Optical coherence tomography*

RPE.....*Retinal pigment epithelium*

SD-OCT .....*Spectral domain- optical coherence tomography*

TD-OCT .....*Time domain- Optical coherence tomography*

INTRODUCTION

Age-related macular degeneration (AMD) is one of the leading causes of vision loss in people over the age of 50 in the developed world. The role of the choroid in the pathogenesis and progression of dry AMD through the formation and accumulation of drusen deserves further investigation. The choroid provides the only circulation for the retinal pigment epithelium (RPE) and outer retina. Therefore, it is the primary means of metabolic support for these tissues ***(Berenberg et al., 2012).***

Spectral domain optical coherence tomography (SD-OCT) is a relatively new technology that allows detailed imaging within the retina, including the photoreceptor layer and RPE, as well as the choroid ***(Yehoshua et al., 2011)***. High-definition SD-OCT has previously been used to measure choroidal thickness in AMD ***(Manjunath et al., 2011)***. It has been demonstrated that enhanced depth imaging (EDI) SD-OCT, which produces an inverted image, can be used to visualize the choroid even better**,** The new technology has lead to better understanding of the role of choroid in various macular diseases, including central serious chorioretinopathy, high myopia **,** Vogt–Koyanagi–Harada disease and a variety of retinal dystrophies ***(Al-latayfeh et al.,2010)***

Chapter 1

ANATOMY OF THE CHOROID

The choroid is a highly vascular and pigmented tissue that light to dark brown and spongy in appearance lies between the retina and sclera Figure (1) and that has a histologic thickness between 0.10 to 0.15 mm (anterior) and 0.22 mm (posterior pole). The vascular supply of the outer retina is maintained by the choroid that forms the posterior part of the uveal tract. It extends from the ora serrata anteriorly to the optic nerve posteriorly ***(*Mund , Rodrigues and Fine ,*1972).***

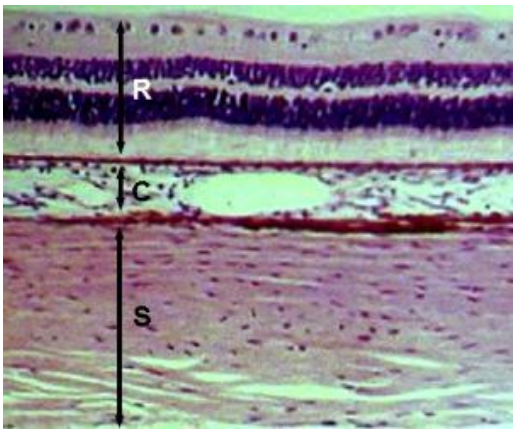

Figure (1): Cross-section through the fundus of the eye, showing the retina (R), sclera (S), and the choroid (C) middle layer ***(*Mund , Rodrigues and Fine ,*1972).***

The choroid receives 80% of all ocular blood compared with 15% to the iris and the ciliary body and 5% to the retina. The outer retina, containing the RPE and the photoreceptors, are avascular and depends on the vascular support (Figure 2) provided by the adjacent choroid ***(Wybar, 1954).***

Venous collecting vessels emerge that ultimately exit the eye through the vortex veins. In addition to the choroid, the vortex veins also drain the ciliary body and iris circulation ***(Wybar, 1954).***

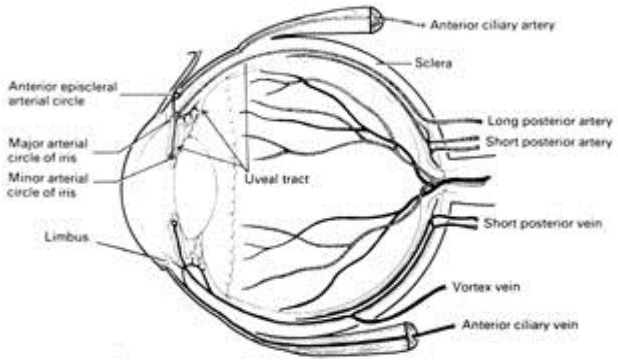

Figure (2): Diagrammatic representation of a transverse section of the globe showing the relationships between the anterior ciliary, short posterior ciliary, and long posterior ciliary arteries ***(Wybar, 1954).***

The structure of the choroid is generally divided into four layers (classified in order of furthest away from the retina to closest):

- **Haller's layer** - outermost layer of the choroid consisting of larger diameter blood vessels.
- **Sattler's layer** - layer of medium diameter blood vessels.
- ***Choriocapillaris*** - layer of capillaries.
- **Bruch's membrane** inner most layer of the choroid Figure (3) ***(Weiter and Ernest, 1974).***

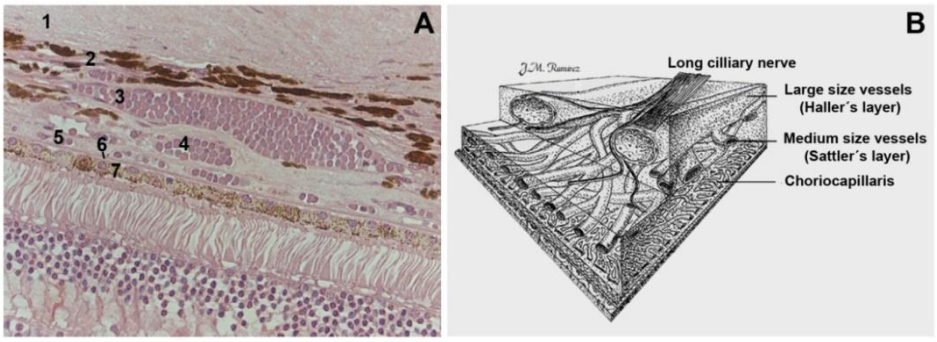

Figure (3): Choroidal vascular layers. A: Histological section 1: Sclera; 2: Suprachoroid; 3: Large-sized- vessel layer (Haller´s Layer); 4: Medium-sized-vessel layer (Sattler´Layer); 5: Choriocapillaris; 6: Bruch´s membrane; 7: retinal pigment epithelium ***(Weiter and Ernest, 1974).***

Choriocapillaris

The choriocapillaris and its unique structure are crucial in enabling the choroid to perform its functions. The choriocapillaris is the capillary layer of the choroid (Figure 4) ***(Mund & Rodrigues and Fine, 1972)***.

Multiple fenestrations with covering diaphragms are present on the capillary wall, especially on the internal side Fenestrations are also noted on the other side of the capillary, but are much less frequent. Pericytes occasionally are seen on the outer wall. Connective tissue is present between vessels and provides support for the vascular system ***(Mund & Rodrigues and Fine, 1972).***

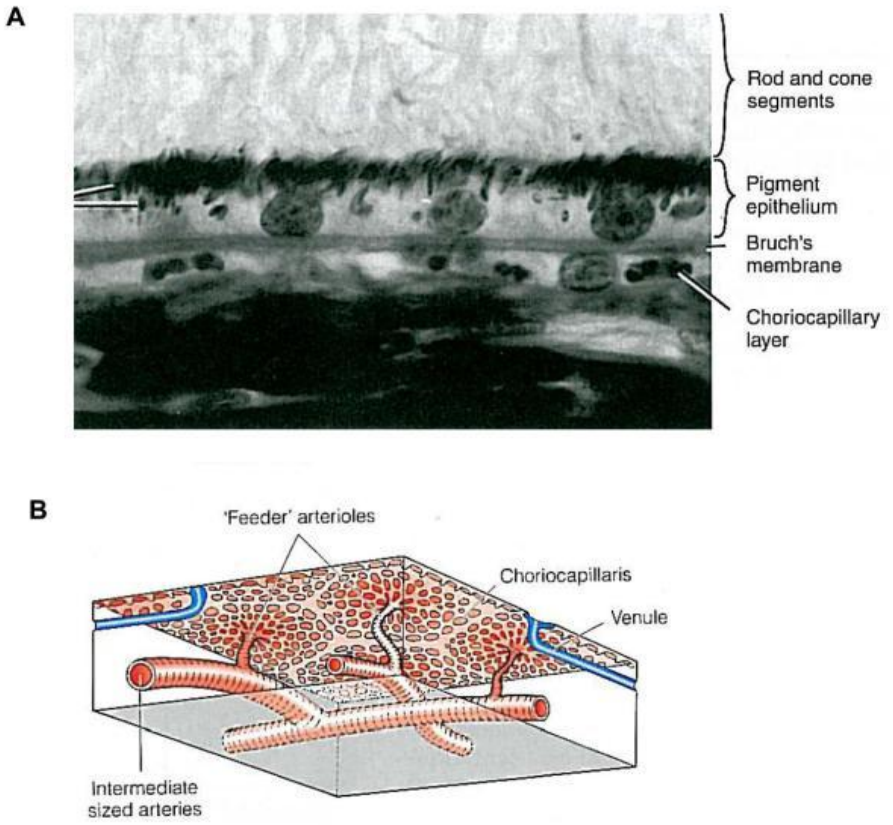

Figure (4): Histology of the choriocapillaris. A. The choriocapillaris is located adjacent to Bruch's membrane. B. Each feeder arteriole in Sattler's layer supplies a hexagonally-arrayed area of capillaries ***(Mund & Rodrigues and Fine, 1972).***

Bruch's membrane

Bruch's membrane is 2 to 4 μm thick, while in the periphery it is only 1 to 2 μm thick. Electron microscopy reveals five distinct parts to Bruch's membrane: the basement membrane of the retinal pigment epithelium, inner collagenous zone, elastic fiber area, outer collagenous zone, and the basement membrane of the endothelium of the choriocapillaris (Figure 5) ***(Weiter and Ernest, 1974)***.

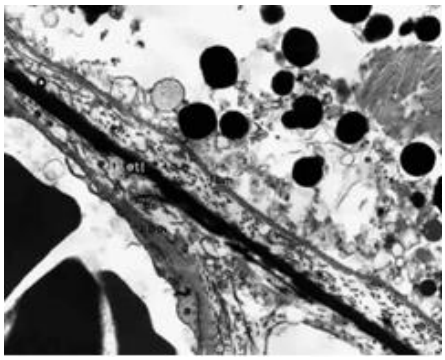

Figure (5): Bruch's membrane. Basement membrane of retinal pigment epithelium, inner collagenous zone, elastic tissue layer, outer collagenous zone and basement membrane of choriocapillaris ***(Mund & Rodrigues and Fine, 1972).***

Anatomy of the retinal pigment epithelium:

The retinal pigment epithelium (RPE) is a monolayer located external to the neurosensory retina. This layer corresponds to the outer layer of the embryologic optic cup. RPE cells are hexagonal and high columnar at the posterior pole, gradually becoming flatter, wider, and less densely pigmented towards the periphery. And the retinal pigment epithelium is more firmly adherent to the choroid than to the photoreceptors ***(Wolff, 1933)***.