MACULAR DEGENERATIONS

THESIS

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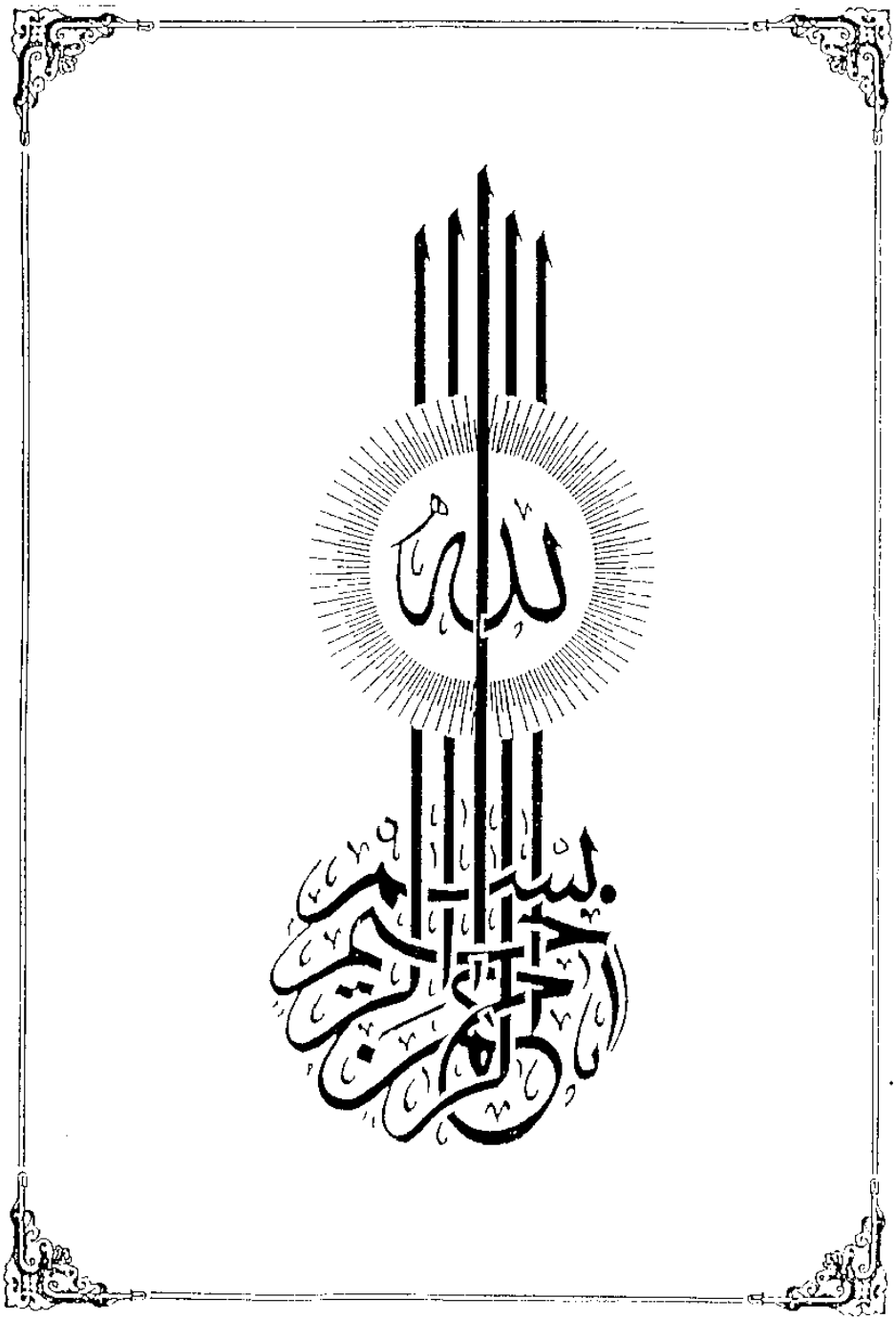

C O N T E N T S

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INTRODUCTION

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This essay is a review of the literature about macular degenerations. As the macula is the most sensitive part of the retina with the highest visual acuity, macular affection is very serious and usually leads to marked diminution of vision. Macular degenerations form the most common cause of blindness. Their treatment presents a formidable clinical challenge. Fluorescein angiography and photocoagulation in selected cases represent major advances in the classification and therapy of these conditions. Many diseases can cause macular degenerations. The macula may be affected primarily (Heridofamilial), or secondarily. The basic pathology appears to be confined to the choriocapillaris, Bruch's membrane and retinal pigment epithelium. Whatsoever might be the cause, macular degeneration is a progressive process of bad prognosis due to insufficient curative methods of treatment.

ANATOMY OF THE MACULA

MACROANATOMY OF THE MACULA

The macular area is a horizontally elliptical shallow depression at a point that corresponds roughly to the posterior pole of the eye. Its centre lies 3.5 mm. (1.5 disc diameter) from the temporal border of the optic disc and about I mm inferior to its centre. Its diameter is about 5.5 mm.

According to (El-Masri, 1979), the macula is situated midway between the nasal end of the inferior oblique insertion and the optic nerve sheath and below the point of entery of the long posterior ciliary artery by about 1.5 mm.

The macula is recognised partly by the contrast of its colour with that of the paler surrounding fundus and partly by the halo or annular reflex which sometimes defines its outline. The macula lutea or, yellow spot, is an ill-defined area smaller than the macular area and varies in extent recognised clinically in examination with red-free light. It is characterised by the presence of a yellow pigment (xanthophyll) in the outer plexiform layer, a carotinoid, which is responsible for the term. (Pallantyne and Michaelson).

Ophthalmoscopically, the macula appears as a small oval area of a deeper red than the rest of the fundus because the pigment epithelium is narrower, taller and more regular than elsewhere in the retina and its pigment granules present throughout the cytoplasm, also this area often appears slightly stippled with pigment. With red-free light, it is seen as greenish yellow area in the pale green of the surrounding retina.

The retinal reflexes are fixed in the macular area, and in the centre of the macula, the foveal pit appears as bright reflex (foveal reflex) owing to the reflection of light from its curved wall as the fovea acts as a concave mirror. The region of the clivus is, however, darker than the surrounding retina, because light falling on it is not reflected back through the pupil, also the retina here is very thin and the pigment epithelium is much denser. (Wolff).

Surrounding the dark macular region, a glimmering delicate halo is frequently seen. It may take the form of a fine crescentic or circular while line or appears as a ring of fine lines radiating towards the fovea resembling nerve fibres or show a yellowish metallic lusture, it is more readily observed in

highly pigmental eyes and in young people. (Duke-Elder,

Microanatomy of the macula:

The macular area is distinguished morphologically by the accumulation of ganglion cells in more than the one row (as occurs in the peripheral retina) a characteristic indicative of the density of the percipient and conducting elements. It can be divided from its centre outwards into:

The Umbo which is a small central concavity in the midst of the foveola.

The Foveola (0.3 mm. in diameter) which is a slight dip in the centre of the floor of the foveal pit. At the foveola the retina is reduced to its half thickness, all retinal elements except the muller cells are largely absent, it is formed of cones only, the number of which is estimated at 35.000 cons .

The Fovea is a shallow pit lying about 4 mm to the temporal side of the optic disc and about 0.8 mm. below the horizontal meridian. The variation in site is considerable but the commonest is about the level of the lower margin of optic disc. In the pit, the

bacillary layer increase in thickness to compensate partly the practical disappearance of the inner layers of the retina.

The shape of the pit is that of a shallow bowl with a concave floor, the sides form a curving slope (The Clivus). The diameter of the pit is about 1.5mm. across, the floor of the pit is about 0.4 mm. across. The visual cells in the region of the floor of the fovea are all cones more regularly and closely packed, longer and more tenous than in other regions of the retina, they are slender and may have a rod-like form, however, they differ from rods in having complex feet and in their staining property. One foveal cone synapses with a single midget bipolar cell which in turn synapses with a single midget ganglion cell. The axons of the midget ganglion cells constitute the papillo-macular bundle. As some of the cones are also connected to flat bipolar cells, thus one-to-one conduction is not a solid rule. The number of cones at the fovea is estimated at 100,000 cones.

Outside the central area (fovea & foveola) a few rods appear and some scattered on the clives and more at the periphery of the foveal excavation.

The bacillary layer in the central retina is formed of cones only, but these are extremely delicate and attenuated, owing to their length, the layer is thicker than elsewhere in the retina, which makes the external lining membrane bulge inward (The fovea externa).

At the fovea, the cone and (peripherally) the rod processes retain their vertical orientation dispite the displacement of bipolar and ganglion cells to the periphery. But the inner and outer fibres of the photoreceptors are inclined obliquely towards the periphery of the macula. In the circumfoveal part of the fovea, along the clivns of the whole foveal depression, the other retinal layers are increasingly presented but the horizontal course of the inner photoreceptor fibres, travelling away from the central foveal point to reach their displaced bipolar and other neurones, produce collectively an external plexiform lamina here known as Henle's layer.

The Parafovea:

Is a belt 2.1 mm wide around the fovea where, owing to its accommodation of the inner cone segments from the central area, accumulation of bipolar and ganglion cells is to be found. Here each cone is in

general separated from its neighbour by one rod. The inner segments of cones in this region are thicker than in the fovea.

The Perifovea:

Forms a belt about 1.5 mm. across wherein the cones, while retaining approximately the same dimensions as those of the parafovea, are more widely separated. So that in general there are two rods between each, thus the density of cones decrease markedly and the cone pedicles are somewhat larger. Across the perifovea the ganglion cell layer gradually decreases from 4 to I cell thick and giant cells appear for the first time and the outer plexiform layer changes from Henle's layer to a more usual arrangement. Over the macular region, the pigment epithelium and the adjoining capillary bed are increased.

Macular Fibres:

Are non myelinated, consist of axons of the ganglion cells. They constitute a well-defined papillo-macular bundle which assumes an oval shape extending from the macular region to the temporal margin of the optic disc. Fibres from the nasal edge of

the macula travel directly, those from the temporal side with those from the upper and lower parts take an arcuate course to reach the optic disc. In the retina, the line dividing the nasal from temporal fibres passes through the centre of the fovea, hence the temporal macular fibres remain on the same side while nasal ones cross.

Blood supply of the macula:

The macular region is supplied by twigs from the superior and inferior temporal vessels, but the fovea itself is, over an area about 0.5 mm in diameter, entirely free of all blood vessels. The fine twigs terminate in a plexus of capillaries which form an arcade around the fovea. The capillaries are of three-layered pattern. The avascular fovea receives most of its nutrition from the choroid, where, however, there is no special submacular arterioles.
A cilioretinal artry derived from the circle of Zinn running from just within the temporal edge of the optic disc towards the macula and supplying this area is not uncommonly seen. Such a vessel may be insignificant twig or it may be as large as a principal retinal artry and provides for the supply of a large section of the retina.

According to El-Masri (1979), it is an early branch of the long posterior ciliary artry which courses lateral to the optic nerve and sends a cluster of vessels to the submacular region.