Faculty of Medicine

Relationship between central corneal thickness and intraocular pressure in the Egyptian population

Thesis

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Abbreviations

AC: Anterior Chamber

ASOCT: Anterior Segment Optical Coherent Tomography

C/D: Cup-disc

CCT: Central Corneal Thickness

CH: Corneal Hysteresis

CI: Confidence Interval

CMTF: Confocal Microscopy Through Focusing

COAG: Chronic Open Angle Glaucoma

DALK: Deep Anterior Lamellar Keratoplasty

DCT: Dynamic Contour Tonometry

EGPS: European Glaucoma Prevention Study

GAGs: Glycosaminoalycans

GAT: Goldmann Applanation Tonometer

ICRS: Intracorneal Ring Segment

IOP: Intraocular Pressure

IOPcc: Corneal Compensated Intraocular Pressure

IOPg: Goldmann equivalent Intraocular Pressure

ITC: Iridotrabecular Contact

LASEK: Laser Epithelial Keratomileusis

LASIK: Laser assisted In situ Keratomileusis

NCT: Non-contact Tonometer

NRR: Neuroretinal Rim

OBF: Ocular Blood Flow

OCT: Optical Coherent Tomograph

OHTS: Ocular Hypertension Treatment Study

OLCR: Optical Low Coherence Reflectometry

ORA: Ocular Response Analyzer

PACG: Primary Angle closure Glaucoma

PAS: Periodic Acid-Schiff

PC: Posterior Chamber

PGs: Prostaglandins

RNFL: Retinal Nerve Fiber Layer

PITX2: Pituitary Homeobox 2 gene

POAG: Primary Open Angle Glaucoma

PRK: Photorefractive Keratectomy

PSD: Pattern Standard Deviation

PXS: Pseudoexfoliation Syndrome

TM: Trabecular Meshwork

UBM: Ultrasound Biomicroscopy

US: Ultrasound

Introduction

Measurement of intraocular pressure (IOP) is fundamental to the management of glaucoma.[1]The accuracy of IOP measurement is considered by some authors to be a "myth" of modern ophthalmology. During the 1970s, Ehlers and Hansen found a close relationship between IOP values and corneal thickness. Later, significant changes in IOP values observed by refractive surgeons after EXCIMER laser and, more recently, findings of the multicenter randomized American Ocular Hypertension Treatment Study (OHTS) in ocular hypertension, confirmed that corneal thickness appears to be important when interpreting IOP estimates.[2]

With the fast development of refractive surgery, central corneal thickness (CCT) has become important in choosing surgery modality and assessing prognosis. Meanwhile, CCT has an important role in the diagnosis of glaucoma. Previous studies have revealed the positive relationship between CCT and IOP among adults. Every 10 μm increase in CCT leads to 0.15-1.0 mmHg increase in IOP. The CCT as well as the IOP is important for assessing glaucoma considering the low CCT will lead to the underestimation of IOP and interfere with the prognosis of glaucoma. The accurate IOP measurement is vital for the early diagnosis and timely treatment of glaucoma.[3]

In the Egyptian medical literature, no study has yet been conducted on the average CCT and IOP. However, many studies have been conducted on Caucasian population.[4] What is real about the Egyptian normal population? What is the relation between CCT and age, gender and IOP? These are the questions that drove us to carry out a clinic-based study in a sample of normal Egyptians aiming at providing the answers.

Aim of the work

Our goal is to determine the profile of CCT and IOP in the Egyptian normal/ nonglaucomatous population and their relationship with each other, together with their relationships with age and gender.

Chapter 1: Intraocular pressure

The balance between the rate of aqueous secretion and outflow determines the intraocular pressure (IOP). The aqueous outflow is in turn related to the level of episcleral venous pressure and the resistance encountered in the outflow channels. The outflow rate is proportional to the difference between the intraocular and episcleral venous pressure.[5]

Aqueous humour secretion:

It is produced in two steps. At first it is formed of plasma filtrate within the stroma of the ciliary body. Afterwards, it's formed from this filtrate across the blood-aqueous barrier. There are two mechanisms involved in this process namely active secretion and passive secretion. While non pigmented ciliary epithelium is responsible for active secretion (that accounts for the vast majority), passive secretion is accomplished by ultrafiltration and diffusion, which are dependent on the capillary hydrostatic pressure, oncotic pressure (colloid osmotic pressure exerted by proteins in blood plasma) and the level of the IOP, is thought to play a minor role in the genesis of aqueous humour under normal conditions.[5]

Aqueous outflow: Anatomy (trabecular meshwork & Schlemm canal): The trabecular meshwork (TM) is a sieve-like structure at the angle of the anterior chamber (AC), 90% of the aqueous humour exits the eye via this meshwork.

TM consists of:

1. The uveal meshwork, the innermost portion, where the

intertrabecular spaces are relatively large and offer little resistance to the passage of aqueous.

2. The corneoscleral meshwork, the larger middle portion, where the intertrabecular spaces are smaller than those of the uveal one, conferring greater resistance to flow.

3. The cribriform (juxtacanalicular) meshwork, the outer part of the trabeculum, offering the major proportion of normal resistance to aqueous outflow. This meshwork consists of cells having narrow intercellular spaces.

Schlemm canal which is a circumferential channel in the perilimbal sclera, its inner wall is lined by irregular spindle-shaped endothelial cells containing infoldings (giant vacuoles) which are thought to convey aqueous via the formation of transcellular pores. Its outer wall contains the openings of the collector channel which leave the canal at oblique angles and connect directly or indirectly with episcleral veins.[5]

Physiology

The flow of aqueous is from the posterior chamber (PC) via the pupil into the AC, from where it leaves the eye by two different routes:

1. **Conventional route (trabecular route)**, which accounts for about 90% of aqueous outflow. The aqueous exits the eye through the TM into the Schlemm canal and is then drained by the episcleral veins (Fig.1 [A]). Trabecular outflow is a bulk flow pressure-sensitive route so that increasing the pressure head will increase outflow. It can be increased by drugs as miotics and sympathomimetics.

2. **Unconventional route (uveoscleral route)**, which accounts for the remaining 10%. Here, aqueous passes across the face of the ciliary body into the suprachoroidal space and is drained by the venous circulation in the ciliary body, choroid and sclera (Fig.1 [B]). It is decreased by miotics and increased by atropine, sympathomimetics and prostaglandin analogues. Interesting to know that some aqueous also drains via the iris (Fig.1 [C]).[5]

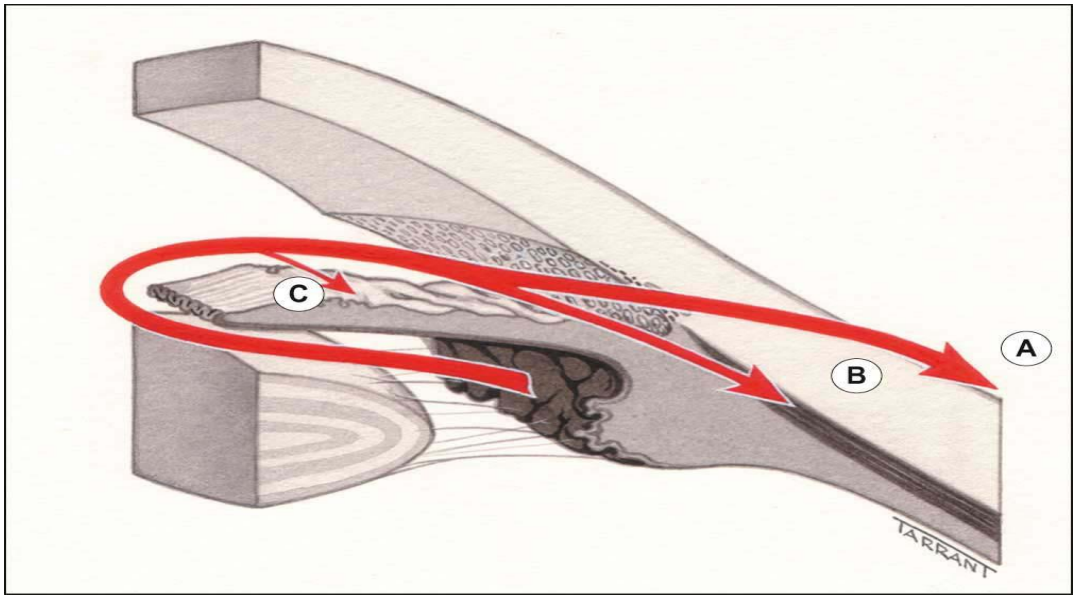

Figure 1: A: Trabecular route, B: Uveoscleral route and C: Iris route.[5]