Jurnal Kesehatan Prima

http://jkp.poltekkes-mataram.ac.id/index.php/home/index

p-ISSN: 1978-1334 (Print); e-ISSN: 2460-8661 (Online)

Central Corneal Thickness in Ocular Hypertension Patients in Sanglah General Hospital Bali

I Gusti Ayu Ratna Suryaningrum[1]✉, I Made Agus Kusumadjaja[2], Ni Made Laksmi Utari[3]

[1,2]Ophthalmology Department, Faculty of Medicine, Udayana University, Sanglah General Hospital, Bali, Indonesia

[3]Ophthalmology Department, Faculty of Medicine, Udayana University, Udayana University Hospital, Bali, Indonesia

✉ratna_suryaningrum@yahoo.com,Phone: +628179743247

Received:30 November 2020/Accepted:15 February 2021/Published Online:28 February 2021

Abstract

Ocular hypertension (OH) is a risk factor in glaucoma and modifiable in its early stages. Goldmann applanation tonometer (GAT) is still the gold standard in measuring intraocular pressure (IOP) which is an important parameter in diagnosing and managing glaucoma. Several factors can affect the accuracy of the GAT, one of them is the thickness of the central cornea. This descriptive study was intended to describe the central corneal thickness (CCT) characteristics of the OH patients. The study was conducted at Eye Clinic - Sanglah General Hospital Denpasar which involved 32 patients with 46 eyes diagnosed with HO in 2018. The mean age of subjects was 43.98 (± 17.92), men had a larger proportion (68.1 %). Sixty six per cent of patients were diagnosed with bilateral OH. In this study, the mean central corneal thickness in HO subjects was 573.81 ± 33.46 µm. The patients' median vertical cup to disc ratio at the time of diagnosis was 0.33, with a mean visual acuity of 0.85. The median value of IOP at the first time of examination was 24.47 mmHg. Central corneal thickness is known to have a positive correlation with IOP, thus affecting the accuracy of IOP measurements. The thicker central corneal thickness will lead to overestimation of the IOP and the thinner one will cause underestimation.

Keywords: Ocular Hypertension;Glaucoma;Intraocular Pressure;Central Corneal Thickness

INTRODUCTION

Glaucoma is a worldwide leading cause of irreversible blindness. It is usually associated with an intraocular pressure (IOP) above the normal range which causes damage of optic nerve head with progressive loss of retinal ganglion cells and the axons, leading to a progressive visual field loss (Weinreb et al, 2014). However, some of patients may have a raise of IOP without glaucomatous optic neuropathy, referred to Ocular Hypertension (OH), and the other may have glaucoma with normal IOP (Normal Tension Glaucoma – NTG) (American Academy of Ophthalmology, 2018).

The diagnosis of Ocular Hypertension must meet some criterias, such as IOP that is greater than 21 mmHg in one or both eyes measured by Goldmann Aplannation Tonometer (GAT) on two or more occasions, no glaucomatous defect on visual field examination, normal view of the optic disc and nerve fiber layers, open angle in gonioscopy, and absence of other eye conditions that contributed to the increase of eye pressure (Chang-Godinich, 2018).

Some studies in the population have found that 4-10% of the population aged 40 years or over will have an IOP of 21 mmHg or more without

detectable signs of glaucomatous damage. The prevalence of ocular hypertension is 10-15 times higher than that of primary open-angle glaucoma (Chang-Godinich, 2017). A relatively thin cornea (CCT <555 μm) was associated with a threefold greater risk for primary open-angle glaucoma than a thick cornea (>588 μm). Abnormalities in corneal hysteresis, myopia, and other disc or peripapillary changes may also play a role (Tsai et al, 2011). The Ocular Hypertension Treatment Study demonstrated that CCT is an independent predictive factor in the later development of glaucoma of OH patients, with thinner CCT increased the glaucoma risk. This finding was externally verified by the European Glaucoma Prevention Study (Brandt, 2012).

The Barbados study found the incidence of IOP above 22 mmHg was five times higher in black than white individuals, while the Baltimore study found no difference between the two races. This condition seems to be more common in women (Chang-Godinich, 2018). Based on age, the prevalence of OH increased significantly with age (Gordon et al, 2018)

Studies examining the relationship between the structural characteristics of the cornea and glaucoma and ocular hypertension found that corneal hysteresis was found to be higher in patients diagnosed with OH. This suggests that corneal hysteresis may have a protective role in these patients (Anderson, 2016). Structural changes, such as changes in tissue compliance, particularly in the optic nerve, may reflect changes in the patient's susceptibility to disease progression and development. Corneal hysteresis is also known to be affected by age, so that age-related tissue remodeling is reflected in a decrease of corneal hysteresis. The evidence regarding biomechanical response of the eye to elevated IOP affects the degree of glaucomatous damage, makes this as a target for glaucoma therapy (Burgoyne, 2016; Murphy et al, 2017).

Evaluation of the need for treatment of OH is carried out in each patient by considering the high monthly costs of glaucoma treatment together with the possible risk of adverse events or toxic reactions from the drug, the inconvenience of use and the uncertainty about prophylactic therapy for OH (Chang-Godinich, 2018). Asia Pacific Glaucoma Guidelines (2016) recommends to treat OH patients with IOP> 26 mmHg, patients with CDR vertical widening, visual field examination shows a high Pattern Standard Deviation (PSD), and if there is a family history of glaucoma. Once the decision to treatment has been made, a targeted IOP range or percentage reduction in IOP should be determined. A reduction in IOP of 20% -25% is an achievable goal in the majority of patients with currently available drugs. However, some patients will still progress to glaucoma, and the therapy needs to be more aggressive so the target IOP can be reached (Brandt, 2016).

The progression from OH to glaucoma is thought to increase with higher IOP and lower central corneal thickness and certain characteristics are associated with more than 2% increase in annual risk for developing glaucoma. The characteristics associated with the risk include CCT less than 555 μm (annual risk 3.4%), vertical cup-to-disc ratio greater than 0.30 (annual risk 2.5%), African-American race (annual risk more than 2%) (Tsai et al, 2011).

Corneal thickness (CCT) is known as an independent predictive factor for the occurrence of glaucoma in patients with OH, with thinner CCTs having a higher risk of glaucoma. The right concept of OH is needed to give a comprehensive management for the patients, so the target IOP can

be achieved to prevent the progression from OH to primary open angle glaucoma.

This study was conducted to provide an overview about central corneal thickness in Ocular Hypertension patients in Sanglah General Hospital Denpasar Bali.

METHOD

This study is an observational study and is conducted with permission from the ethics committee of Medical Faculty – Udayana University / Sanglah General Hospital number 1838/UN14.2.2.VII.14/LP/2019. Data regarding characteristics and ophthalmology examination of OH patients were collected retrospectively based on medical records. The characteristics of data taken in this study include gender, age, family history of glaucoma, central corneal thickness (Zeiss Stratus Optical Coherence Tomography), visual acuity, intraocular pressure (Goldmann Aplanation Tonometry), and the amount of anti-glaucoma drugs.

Samples of the study were all patients with Ocular Hypertension in 2017-2018 who met the inclusion and exclusion criteria. The collected data were then processed using SPSS 23.0

RESULTS AND DISCUSSION

Table 1. Characteristics of Subjects

Characteristics	
Age (Mean ± SD)	43.98 ± 17.92
Gender (%)	
Male	68.1
Female	31.9
CDR (Median / Min – Maks)	0.33 / 0,20 – 0.50
VA (Median / Min – Maks)	0.85 / 0,10 – 1.00
IOP (Mean / Min – Maks)	24.47/ 11.00 – 36.00
Laterality (%)	
Unilateral	34
Bilateral	66
CCT (Mean ± SD)	573.81 ± 33.46
Glaucoma Treatment (%)	
Yes	19.1
No	80.9

CDR = *Cup disc ratio;* VA = visual acuity; IOP = intraocular pressure; CCT : *Central Corneal Thickness*

During the period of January 1, 2018 to December 2018, there were 32 patients with 46 eyes diagnosed with ocular hypertension at Sanglah General Hospital, Denpasar.

Table 1 shows the characteristics of patients with OH. The mean age of patients diagnosed with ocular hypertension was 43.98 (± 17.92). Men had a bigger proportion (68.1%) than women (31.9%). As many as 34% with unilateral OH and 66% bilateral. The median value of the patient's cup disc ratio at the time of diagnosis with ocular hypertension was 0.33 (0.20 - 0.50). The mean

visual acuity was 0.85 (0.10 - 1.0). The median value of IOP at first examination was 24.47 mmHg (11.00 - 36.00).

Ocular Hypertension is an eye disorder with an intraocular pressure of 21 mm or more with a normal optic disc and visual field. Elevated IOP is a major risk factor for primary glaucoma, and is the only modifiable risk factor. Some studies in the population have found that 4-10% of the population aged 40 years or older will have an IOP of 21 mmHg or more without detectable signs of glaucomatous damage. Ocular hypertension has a 10-15 times higher prevalence than primary open-angle glaucoma (Hu et al, 2016). In this study, the mean age of patients with ocular hypertension was 43.98 ± 17.92, with an age range of 14 - 75 years. Based on age, the prevalence of OH increased significantly with age.

Study by Simsek et al. (2005) found more male patients than female. Study by Caporossi et al. (2007), of 33 patients with open angle glaucoma, there were 12 female patients and 21 male patients. In this study male had a greater proportion (68.1%) than female (31.9%). According to some studies there is no gender preference in the incidence of glaucoma. Other literature states that men are at risk of primary open angle glaucoma. Several surveys in the population show that women have a high risk of developing open-angle glaucoma.Clinical features in patients with ocular hypertension include increased intraocular pressure, which generally occurs bilaterally, and a normal cup to disc ratio of 0.2 - 0.41. In this study the median CDR value of glaucoma patients was 0.33 (0.20-0.50).

A comprehensive eye examination is necessary to diagnose OH, excluding primary open-angle glaucoma or other secondary causes of glaucoma. Ophthalmological examination is performed to assess visual acuity, intra-ocular pressure, presence of abnormalities in the anterior segment, evaluation of the angle with gonioscopy to rule out angle closure or secondary causes of raised IOP. In this study, the visual acuity of patients was 0.85 (0.10 - 1.0). Meanwhile, the mean intraocular pressure (IOP) was 24.47 mmHg with a range of 11.00 - 36.00 mmHg. Mohammed et al. (2009) found a strong positive correlation between mean central corneal thickness and intraocular pressure ($p < 0.001$, $r = 0.72$) .

The clinical implication of correlation of mean central corneal thickness to intraocular pressure is that intraocular pressure (obtained from measurements, Goldmann applanation tonometer) depends on corneal rigidity which corresponds to the thickness of the central cornea. In this study, the mean central corneal thickness in Ocular Hypertension subjects was still in normal range 573.81 ± 33.46 µm.

CONCLUSION

The clinical significance of CCT is well recognized in the context of glaucoma and ocular hypertension diagnosis and management, though its importance remains debatable. In this study the mean CCT in subjects all in normal range.

REFERENCES

American Academy of Ophthalmology. (2017). *BCSC: Glaucoma*. San Fransisco: American Academy of Ophthalmology. p. 159- 163.

Anderson, D. R. (2016). IOP: The Importance of Intraocular. In J. A. Giaconi, S. K. Law, K. Nouri-Mahdavi, A. L. Coleman, J. Caprioli (Eds.), *Pearls of*

Glaucoma Management. Berlin: Springer. p. 85-90.

Asia Pacific Glaucoma Society. (2016). *Asia Pacific Glaucoma Guidelines*. 3rd ed. Amsterdam : Kugler Publications, p.34.

Brandt JD, Gordon MO, Gao F, Beiser JA, Miller JP, Kass MA; Ocular Hypertension Treatment Study Group. Adjusting intraocular pressure for central corneal thickness does not improve prediction models for primary open-angle glaucoma. Ophthalmology. 2012;119(3):437-42. https://doi.org/10.1016/j.ophtha.2011.03.018.

Brandt, J. D. (2016). IOP: Central Corneal Thickness. In J. A. Giaconi, S. K. Law, K. Nouri-Mahdavi, A. L. Coleman, & J. Caprioli (Eds.), *Pearls of Glaucoma Management*. Berlin: Springer. pp. 101-108. https://doi.org/10.1007/978-3-540-68240-0_10

Burgoyne, C. F. (2016). Optic Nerve: The Glaucomatous Optic Nerve. In J. A. Giaconi, S. K. Law, N.-M. Kouros, A. L. Coleman, & J. Caprioli (Eds.), *Pearls of Glaucoma Management.* Berlin: Springer. pp. 1-16. https://doi.org/10.1007/978-3-540-68240-0_10

Chang-Godinich, A. (2018). *Ocular Hypertension.* Retrieved June 5, 2018, from emedicine Medscape: https://emedicine.medscape.com/article/1207470- overview

Gordon, M.O., Kass, M.A. (2018). From Perspective: What We Have Learned The Ocular Hypertension Treatment Study. *Am J Ophthalmol.* 189: 24-27. https://doi.org/10.1016/j.ajo.2018.02.016

Hu, Y., & Danias, J. (2017). Noninvasive Intraocular Pressure Measurement in Animals Models of Glaucoma. In T. C. Jakobs (Ed.), *Glaucoma - Methods and Protocols*. Berlin : New York, USA: Humana Press. pp. 49-62.

Mohamed, NY, Hassan MH, Ali NAH, Binnawi H. (2009). Central Corneal Thickness in Sudanese Population. *Sud J Ophthalmol*; I: 29–32.

Murphy, M. L., Pokrovskaya, O., Galligan, M., & O'Brien, C. (2017). Corneal hysteresis in patients with glaucoma-like optic discs, ocular hypertension and glaucoma. *BMC Ophthalmology*, *17*(1).

Tsai, J. C., Denniston, A. K., Murray, P. I., Huang, J. J., & Aldad, T. S. (Eds.) (2011). *Oxford American handbook of ophthalmology.* New York: Oxford University Press. p.267-268