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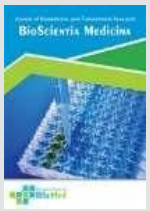

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Comparison of Central Corneal Thickness and Lamina Cribrosa Thickness in Ethnic Indians and Ethnic Malays as Predictors of Glaucomatous Optic Neuropathy

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A B S T R A C T

Background: Glaucoma poses a public health problem because it is the second leading cause of blindness after cataracts. A thinner central corneal thickness (CCT) is also a contributor to the development of primary open-angle glaucoma (POAG). Lamina cribrosa (LC) is a structure of the optic nerve head (ONH). LC structural changes such as thinning, posterior displacement, and connective tissue deficiency are associated with the mechanism of retinal nerve fiber layer (RNFL) thickness damage, leading to glaucomatous optic neuropathy. **Methods:** Cross-sectional analytic observational study. A total of 36 eyes from 36 research subjects participated in this study. Data analysis was carried out using SPSS version 25. Then, univariate and bivariate analyzes were carried out to see the difference in CCT and LC thicknesses. **Results:** The average CCT in ethnic Indians is 514.33 ± 14,142 µm and in ethnic Malays, 542.06 ± 17,234 µm. In this study, there were differences in the average CCT in Indian ethnicity and Malay ethnicity, which was statistically meaningful with a p-value = 0.000. **Conclusion:** There are differences in the average central corneal thickness and lamina cribrosa thickness in ethnic Indians compared to ethnic Malays, where the central corneal thickness and lamina cribrosa thickness in ethnic Indians are thinner than ethnic Malays.

1. Introduction

Glaucoma is a group of diseases characterized by characteristic optic neuropathy consistent with the remodeling of the connective tissue elements of the optic nerve papillae and loss of nerve tissue associated with the development of characteristic visual field defects.[1] Glaucoma poses a public health problem because it is the second leading cause of blindness after cataracts. It is estimated that 57.5 million people worldwide suffer from primary open-angle glaucoma (POAG), with a global prevalence of 2.2%.[2] In 2040, glaucoma sufferers are estimated to reach 111.8 million people.[3] Ethnic differences are known to be a risk factor for POAG. African ethnicity has the highest prevalence of POAG, almost 3 times that of whites, which is 5.2%. Africans are reported to have a smaller trabecular meshwork which reduces aqueous humor outflow. In addition, the thinner central corneal thickness (CCT) is another contributor to the development of POAG. Asia accounts for about 60% of the global glaucoma population. The prevalence of POAG varies across Asia. South Asia has the highest prevalence of POAG compared to other regions, with glaucoma prevalence in India at 4.6%.[4,5] The prevalence of POAG among ethnic Malays is 3.2%.[6] This difference in prevalence between ethnicities may be due to differences in CCT, which is a contributor to

the development of POAG.[6,7]

Thin CCT is a risk factor for the progression from ocular hypertension to glaucoma. However, it has not been determined whether this increased risk of glaucoma is simply due to an underestimation of intraocular pressure (IOP) or whether thin CCT is a biomarker for risk factors independent of IOP measurements. The value of IOP measurement using a Goldmann applanation tonometer is influenced by CCT. Goldmann applanation tonometer readings are most accurate when the CCT value is 520 μm. A thicker cornea is resistant to deformation during tonometry, resulting in an overestimated IOP, while a thinner cornea results in an underestimated IOP reading.[8-11]

Lamina cribrosa (LC) is a structure of the optic nerve head (ONH) that consists of connective tissue and provides nutrition to support retinal ganglion cell (RGC) axons. LC is thought to be the main site of axon damage due to the disruption of the axoplasmic flow of RGC axons.[12-14] LC is the primary site of axonal damage, including mechanical damage and vascular supply. LC structural changes such as thinning, posterior displacement, and connective tissue deficiency are associated with the mechanism of retinal nerve fiber layer (RNFL) thickness, leading to glaucomatous optic neuropathy.[15-17] This study is an attempt to explore the relationship between central corneal thickness and lamina cribrosa thickness in Indian and Malay ethnicities as predictors of glaucomatous optic neuropathy.

2. Methods

This study is an analytic observational study with a cross-sectional approach. The research was conducted at the eye polyclinic of Dr. M. Djamil General Hospital Padang Indonesia, July 2022 - September 2022. A total of 36 eyes from 36 research subjects participated in this study, of which 18 subjects were ethnic Indian subjects and 18 subjects were ethnic Malays, where the subjects met the inclusion criteria in the form of not wearing glasses with an emmetropic eye refraction status (6/6 vision without correction), aged 19-28 years, and willing to participate in the study after being given an explanation by signing an informed consent form and agreeing to comply with the rules of the examination to be carried out. This study has been approved by the medical and health research ethics committee, Dr. M. Djamil General Hospital Padang, Indonesia.

This study collects sociodemographic data of research subjects as well as clinical eyes of research subjects, including visual acuity examination, examination of the anterior segment, posterior segment, and intraocular pressure. CCT examination was performed using AS-OCT. The subject of the study sat with the eye being examined for fixation to the point of light on the AS-OCT then the examiner recorded the thickness of the corneal curvature using the pachymetry on the AS-OCT. LCT examination was performed using the EDI-OCT technique. LCT was measured using a caliper tool to measure the distance from the anterior border of the LC to the posterior border of the LC in the EDI-OCT technique. Data analysis was performed with the help of SPSS version 25 software. Univariate analysis was carried out to present the distribution of data from the test variables, and then bivariate analysis was performed to compare the average between the test groups and the correlation test, with $p < 0.05$.

3. Results

Table 1 shows that in the data on the Indian ethnic group, there are more males than females, as many as 14 people (77.8%) with a mean age of 23.72 ± 2.396 years. In ethnic Malays, the most gender is female (55.6%) with a mean age of 22.94 ± 0.998 years. Table 2 shows the average CCT for Indians, which is 514.33 ± 14,142 μm, and 542.06 ± 17,234 μm for Malays. In this study, there was a statistically significant difference in CCT between Indians and Malays with a p-value = 0.000.

Table 1. Characteristics of research subjects by gender and age.

Characteristics	Ethnic Indian		Ethnic Malay	
	n	%	n	%
Gender				
Male	14	77,8	8	44,4
Female	4	22,2	10	55,6
Age (Mean±SD)	23.72 ± 2.396		22.94 ± 0.998	

Table 2. Average CCT and LCT in Indian and Malay ethnicity.

Variable	Ethnic Indian	Ethnic Malay	P-value
	Mean ± SD (µm)	Mean ± SD (µm)	
CCT	514.33 ± 14.142	542.06 ± 17.234	0.000
LCT	211.33 ± 21.001	243.61 ± 12.205	0.000

*T-independent test (p-value <0.05 considered significant).

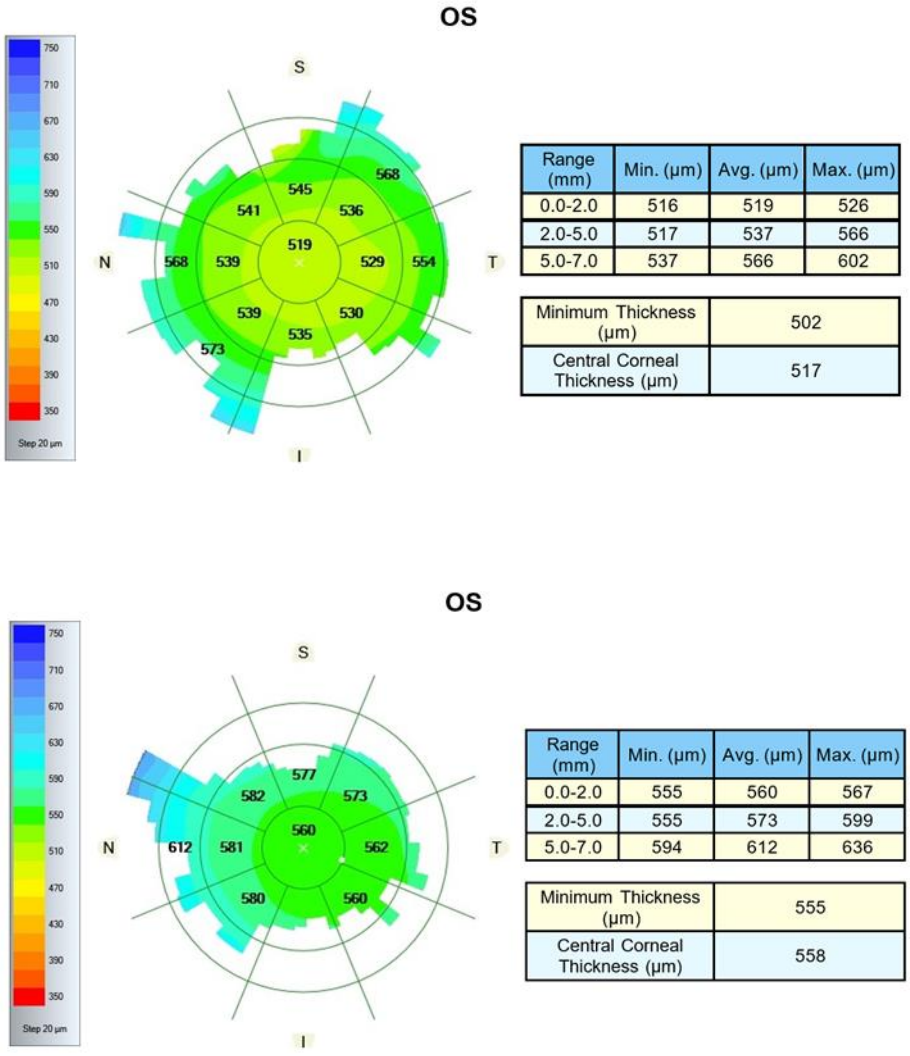

Figure 1. CCT differences in Indian (top) and Malay (bottom) ethnic groups.

4. Discussion

CCT is an important parameter in the assessment of any potential glaucoma patient. OHTS research results demonstrated that CCT is a predictor factor for the development of glaucoma in ocular hypertension, whereas thinner CCT conferred an increased risk of glaucoma. Based on OHTS, over a 5-year period, thin CCT with IOP >25.75 mmHg was a major risk factor for the development of glaucoma in patients with OHT. The risk of developing POAG at 5 years in OHT patients with CCT ≤555 µm was 3 times higher than in persons with CCT >588 µm.[18-21] In this study, the average CCT for Indians was 514.33 ± 14,142 µm, and the average CCT for Malays was 542.06 ± 17.234 µm. From the results of the study, it was found that the average CCT among Indians was thinner than that of Malays. Based on the results of statistical analysis, there was a significant difference in the average CCT between Indian and Malay ethnic groups with p-value = 0.000.

This is in accordance with previous studies that assessed CCT in the Indian population and obtained an average CCT value of 511.4 ± 33.5 µm, where this study is population-based. a cross-sectional study of 6,754 people aged over 20 years using an ultrasonic pachymeter.[22] Another study assessing CCT in 9,370 eyes in an Indian population adult obtained an average CCT value of 514 ± 33 µm (median: 517 m; a range of values 290–696 µm).[23] Another study found that the average CCT in the Malay population aged 40-80 years was 541.2 ± 33.6 µm, almost the same as the average CCT found in school children in Singapore, which was 543.6 ± 32.0 µm.[24] Compared to other Asian ethnic groups and in the world, the average CCT in Malay ethnic groups is thicker than Mongolian (504.5 µm), Japanese (521 µm), and Indian (505.9 µm).[25] Another study conducted a population-based study of ethnic Chinese, Malay, and Indian aged >40 years to assess CCT. From this study, it was found that ethnic Indians had the thinnest average CCT among Chinese and Malays ($p<0.001$).[26]

5. Conclusion

There are differences in the average central corneal thickness and lamina cribrosa thickness in ethnic Indians compared to ethnic Malays, where the central corneal thickness and lamina cribrosa thickness in ethnic Indians are thinner than ethnic Malays.

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