

Correlation Between Cup and Optic Nerve Disc Ratio with High Myopia

Hubungan Rasio Cup dan Diskus Nervus Optikus dengan Myopia Tinggi

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Abstract: High myopia is one of the risk factors for glaucoma, which is often accompanied by abnormalities in the fundus due to excessive stretching. The object of the study is to determine correlation between cup ratio and optic nerve disc with high myopia. This is a non-experimental research, analytic observational with cross-sectional study design. The subjects were patients with myopia with more than - 6.00 diopters at the Kebumen Eye Center Clinic and Purbowangi Gombong Hospital. Data collection was carried out in January - August 2019. The respondents were 30 people, consisting of 14 men (46.7%), 16 women (53.3%), with an average age of 33.07 ± 18.04 years. Mean refraction of right eye (OD / Ocular Dextra) were -10.72 ± 4.82 diopters and left eye (OS / Ocular Sinistra) were -10.27 ± 4.52 diopters. The results of the correlation test using Spearman Test showed that there is no significant correlation (OD p 0.115; OS p 0.118) between the cup ratio and optic nerve disk with high myopia. It conclude that there is no significant correlation between cup ratio and optic nerve disc with high myopia.

Keywords: cup and optic nerve disc ratio; high myopia

Abstrak: Miopia tinggi dapat menjadi faktor risiko terjadinya glaukoma dan sering terdapat kelainan fundus akibat peregangan mata yang berlebihan. Penelitian ini bertujuan untuk mengetahui hubungan antara rasio cup dan diskus nervus optikus dengan miopia tinggi. Penelitian ini merupakan penelitian non eksperimental, observasional analitik, dengan rancangan cross-sectional. Subjek penelitian adalah pasien high miop lebih dari -6,00 dioptri di Klinik Kebumen Eye Centre dan RS Purbowangi Gombong. Data diambil pada bulan Januari - Agustus 2019. Pada penelitian ini terkumpul 30 orang responden yang terdiri atas 14 laki laki (46,7%), 16 perempuan (53,3%), dengan rerata umur $33,07 \pm 18,04$ tahun. Rerata refraksi mata kanan (OD/Ophthalmic Dextra) - $10,72 \pm 4,82$ dioptri dan mata kiri (OS/Ophthalmic Sinistra) $-10,27 \pm 4,52$ dioptri. Hasil uji korelasi Spearman Test menunjukkan tidak ada hubungan yang signifikan (OD p 0,115; OS p 0,118) antara ratio cup dan diskus nervus optikus dengan miopia tinggi. Disimpulkan bahwa tidak terdapat hubungan antara rasio cup dan disk nervus optikus dengan miopia tinggi.

Kata Kunci: rasio cup dan diskus nervus optikus, miopia tinggi

INTRODUCTION

Myopia is a vision problem that is caused by an overly strong accommodation force from the refractory media of the eye or because the axis of the eyeball is too long, causing the focus of the shadows to fall in front of the retina. Most types of myopia are due to the axis of the eyeball that is too long (myopia axis). Every 1 mm axis lengthening will cause myopia 3 diopters.¹ Myopia is the most common refractive disorder. The high myopia is a refractive disorder that can be one of the risk factors for glaucoma (can caused irreversible blindness). In high myopia (more than 6 diopters or extended axis more than 2 mm) often accompanied by abnormalities of the back of the fundus (posterior polus) eyeball due to excessive stretching. Some previous studies have shown that the optic nerve papilla with myopia can resemble the optic nerve papilla with glaucoma, especially in terms of the cup ratio and optic nerve disc.¹⁻⁴

The formulation of the problem in this study is whether there is a relation between cup and optic nerve disc ratio with high myopia for screening incidence of glaucoma in high myopia. The benefit of this study is to see the incidence of glaucoma in high myopia so it can perform the screening of blindness due to glaucoma.

MATERIALS AND METHOD

This study is a non-experimental observational analytic method with a cross-sectional study design. The study was conducted at the Kebumen Eye Center Clinic and Purbowangi Gombong Hospital, in the period of January to August 2019. The study population was all high myopia patients (more than -6.00 diopters) aged 15-70 years. The sample of the study were all myopia patients which met the inclusion criteria. The patients who had undergone eye / laser eye surgery procedures, patients with opacified refractive media or other eye diseases that affected the retina and optic nerve papilla and female patients who were pregnant will exclude from the study.

Statistical analysis using the Spearman Rank Correlation test was performed to determine the relationship between cup and the optic nerve disc ratio with high myopia.⁵ The determination of significance is based on the p value, where if the p value is <0.05, it is interpreted that there is a significant relationship, and vice versa.

RESULT

There are 30 respondents involved in this study, with criteria of suffering from high myopia > -6.00 diopters. The majority of respondents were > 40 years old (43,3%) as shown in Table 1. Respondents mean age 33.07 ± 18.04 years old and consisted of 14 men (46.7%) and 16 women (53.3%) as shown in Table 2. Patients suffer of high myopia with a mean of -10.27 ± 4.52 Diopters in the right eye (OD / Ocular Dextra), and mean of -10.72 ± 4.82 Diopters in the left eye (OS / Ocular Sinistra) with the frequency distribution of samples as shown in Table 3. The majority respondents (86%) have ratio of cup and optic nerve disc is 0.3 and it is normaly. The frequency distribution of ratio cup and optic nerve disc as shown in Table 4.

Table 1. Distribution of Sample Frequencies by Age

Age category	Frequency	Percentage
< 20	12	40
20 - 40	5	16.7
>40	13	43.3
Total	30	100

Table 2. The Frequency Distribution of the Sample by Gender

Gender	Frequency	Percentage
Male	14	46.7
Female	16	53.3
Total	30	100

Table 3. The Frequency Distribution of Refractive Disorders (high myopia)

Refractive disorders (diopters)	OD	OS
-6.00 sd -10.00	20 (66.7%)	21 (70%)
-11.00 sd -15.00	5 (16.7%)	4 (13.3%)
-16.00 sd -20.00	4 (13.3%)	4 (13.3%)
-21.00 sd -30.00	1 (3.3%)	1 (3.3%)
Total	30 (100%)	30 (100%)

Table 4. Frequency Distribution Ratio of the Cup and the Optic Nerve Disc

Cup Ratio and optic nerve disc (OD/OS)	OD	OS
0.3/0.3	26 (86.7%)	26 (86.7%)
0.4/0.4	2 (6.7%)	2 (6.7%)
0.5/0.5	1 (3.3%)	2 (6.7%)
0.6/0.6	1 (3.3%)	0 (0%)
Total	30 (100%)	30 (100%)

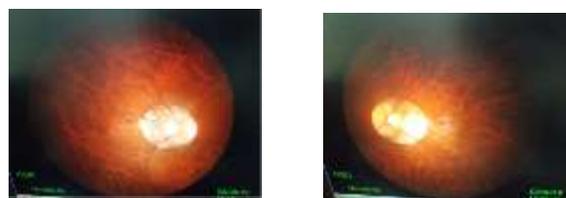


Figure 1. Female patient, 25 years old , spherical OD refraction abnormalities -19.00 D and spherical OS -18.00 D with an ODS CD ratio of 0.3 / 0.3, images of the crescent myopic fundus and retinal degeneration.



Figure 2. Female patient, 13 years old , spherical OD refraction abnormalities -10.5 D, spherical OS -9.25 D with a CD ratio of 0.6 / 0.6 suspected glaucoma.

The results of the correlation test using the Spearman Test showed that there was no significant correlation ($p > 0.01$) between the cup and optic nerve disk ratio with high myopia. Therefore, it shows that its has weak correlation strength ($r 0.29$).

DISCUSSION

High myopia as a risk factor of glaucoma. The fundus (posterior pollus) of the eyeball in high myopia can be found in the expansion of the cup ratio and optic nerve papilla disc, changes in the position and slope of the optic disc, depigmentation around the optic disc, so that it appears thinning sclera and retina, images of myopic crescent, conus myopicus, posterior staphyloma, and myopic degeneration in the optic and retinal nerve papilla, macular degeneration, macular holes, macular bleeding, even retinal detachment, changes in the glassy body in the form of melting resulting in turbidity such as optic nerve and retinal nerve or threads (floaters) felt by the patient.⁶⁻⁸

Correlation between cup and optic disc ratio in high myopia still controversial. This study reports that there is no significant relationship between cup of disk ratio and high myopia with weak correlation. This

shows that it is not automatically that patients suffering from high myopia will have a dilated cup of disk ratio. In this study it that there was a patient with a very high myopia -19.00 D but the cup of disc ratio was still within normal limits.

Qiu (2013)⁹ reported that glaucoma were not significantly increased in subject with mild myopia, moderate myopia and severe myopia. The adjusted odds of vertical cup-to-disc ratio greater than or equal to 0,7 were not significantly increased in subject with mild myopia, moderate myopia and severe myopia.

The results of this study differ from some previous studies which said that high myopia was a risk factor for glaucoma (with a dilated cup of disc). Some literature says that myopia is one of the risk factors for glaucoma. Some previous studies have explained that the optic nerve papilla with myopia can resemble the optic nerve papilla with glaucoma, especially in terms of the cup and optic nerve disc ratio.² Other studies report that even mild myop can be a risk factor for glaucoma. Suzuki and colleagues (2002) observed that narrow-angle and open-angle glaucoma was found in the correction refraction average of -2.12 diopters. Davenport's research (1999)¹⁰ conducted on 1500 glaucoma sufferers found 316 patients had 3 diopters refraction abnormalities. Chen (2002)⁶ found that glaucoma occurred in myopia < 6 diopters. The presumption from Friedman (1994)¹⁰ that the role of myopia as a risk factor in glaucoma has been investigated but the results cannot yet be explained.

Perkins and Phelps in one study said that myopia eyes were more susceptible to the effects of increased intraocular pressure compared to non-myopia eyes and thus became a risk factor for glaucoma. Glaucoma that results from refractive abnormalities is related to the anatomy of the eyeball. In myopia, the patient's eyeballs will increase in length and cause an increase in intraocular pressure (IOP).¹¹

A recent study said within high myopia, glaucoma prevalence increased with larger optic disc size beyond a disc area of 3.8 mm². Highly myopia megalodisc had a 3.2 times higher risk for glaucomatous optic nerve neuropathy. Increased frequency of glaucomatous optic neuropathy (GON) in axially elongated eyes was associated with the size of the optic disc. GON was detected more frequently in highly miopia with an enlarged optic disc than in high miopia with a normal-sized optic nerve head. In the high myopia (cutt of -8 dopters or an axial length of 26,5 mm), the optic disc area enlarge, the lamina cribosa thus enlarges in area and decreases in thickness.¹²⁻¹⁴

The clinical diagnosis of glaucomatous changes in the high myopia optic nerve head is difficult due to the marked changes in the optic nerve head appearance by myopia itself. Glaucomatous optic nerve damage maybe detected late in the course of the disease.¹⁵

CONCLUSION

There is no significant relations between cup and optic nerve disc ratio with high myopia

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REFERENCES

1. Hartono. *Diktat Refraksi*. Yogyakarta: Badan Penerbit Fakultas Kedokteran Universitas Gadjah Mada; 2006.
2. Leung CK, Cheng ACK, Chong KKL, Leung KS, Mohamed S, Lau CSL. Optic Disc Measurements in Myopia with Optical Coherence Tomography and Confocal Scanning Laser Ophthalmoscopy. *Invest Ophthalmol Vis Sci*. 2007; 48: 3178-3183.
3. Iorga RE, Costin D. High Myopia and Glaucoma A Challenge in Diagnosis, Review, *Medical Surgical Journal*. 2018;122 (4). 729-736
4. Balitbangkes Kemenkes RI. *Pokok-Pokok Hasil Riskeddas Provinsi Daerah Istimewa Yogyakarta*. Jakarta : Lembaga Penerbitan Badan Litbangkes; 2013
5. Dahlan S. *Besar Sampel dan Cara Pengambilan Sampel dalam Penelitian Kedokteran dan Kesehatan*, Salemba Medika. Jakarta; 2009. p.34-39.

6. Chen SJ, Lu P, Zhang WF, Lu H. High Myopia as a Risk Factor in Primary Open Angle Glaucoma, *Int. J.Ophthalmol.* 2012; 5 (6) : 750-753.
7. Lee JY, Sung KR, Hau S, Na JH. Effect of Myopia on the Primary Open Angle Glaucoma, *Invest Ophthalmol Vis Sci.* 2015;56 (3): 1775-1781.
8. Dimitri T. Azar MD. American Academy of Ophthalmology 2015-2016: *Clinical optics.* Basic Clinical and Science Course Sect.3. Section Chair; 2013-2014.
9. Qiu M, Wang SY., Singh K, Lin SC. Association Between Myopia and Glaucoma in United States Population, *Invest. Ophthalmol. Vis. Sci.* 2013; 54 (1) : 830-835.
10. Friedman E. 1994. Aging changes of the sclera. In: Albert DM, Jakobiec FA. Eds. *Principles and Practice of Ophthalmology.* Basic Sciences. Philadelphia: WB Saunders Co., 1994;726-727
11. Bowling, Brad. *Kanski's Clinical Ophthalmology*; 2015. P. 928.
12. Jonas JB, Webber P, Nagaoka N, Ohno-Matsui K.. Glaucoma in High Myopia and Parapapillary Delta zone, *Plos One.* 2017; 12 (4), e0175120.
13. Nagaoka N, Jonas JB, Morohoshi K, Moriyama M, Shimada N, Yoshida T, et al. Glaucomatous Type Optic Disc in High Myopia, *Plos One.* 2015; 10 (10):e0138825.
14. Wang YX, Jonas JB. Optic Nerve Anatomy in Myopia and Glaucoma, Including Parapapillary Zones Alpha, Beta, Gamma and Delta: Hystology and Clinical Features. *Prog Retin Eye Res.* 2020 Dec 9;100933. doi: 10.1016/j.preteyeres.2020.100933
15. Jonas JB, Jonas SP, Ohno-Matsui K. Glaucoma in High Myopia, *Update on Myopia*, (pp.241-255). Januari 2020. DOI : 10.1007/978-981-13-8491-2 11