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ASSOCIATION OF MYOPIA AND AXIAL LENGTH WITH RISK OF LATTICE DEGENERATION

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Abstrak

Degenerasi *lattice* merupakan suatu kondisi abnormal pada retina perifer yang disebabkan oleh peregangan dan penipisan lapisan retina perifer. Degenerasi *lattice* meningkatkan risiko terjadinya ablasio retina yang dapat menyebabkan kebutaan. Degenerasi *lattice* sering ditemukan pada mata miopia dan peningkatan panjang aksial bola mata. Penelitian ini bertujuan untuk mengetahui hubungan dan risiko antara degenerasi *lattice* dengan panjang aksial dan derajat miopia diantara mahasiswa di Samarinda. Penelitian ini merupakan penelitian *cross-sectional* yang menggunakan *purposive sampling.* Semua subjek penelitian akan dilakukan pemeriksaan mata meliputi koreksi refraktif, IOLmaster dan oftalmoskopi indirek oleh dokter mata. Jumlah sampel penelitian ini adalah 66 mata miopia. Degenerasi *lattice* secara signifikan berhubungan dengan panjang aksial mata (p=0.002) dan derajat miopia (p=0.001). Degenerasi *lattice* lebih sering terjadi pada miopia derajat berat (69,2%) dan pada mata dengan panjang aksial >26 mm (68,76%). Peningkatan kejadian degenerasi *lattice* juga berhubungan dengan miopia derajat berat (OR:2,754, *P*=0.026) dan panjang aksial mata (OR:2.290, *P*=0.278). Berdasarkan analisis, miopia derajat berat dan peningkatan panjang aksial mata dapat meningkatkan risiko terjadinya degenerasi *lattice*.

***Kata Kunci**: Degenerasi lattice, derajat miopia, panjang aksial*

Abstract

Lattice degeneration is an abnormal condition of the peripheral retina caused by stretching and thinning of the peripheral retina layer. This condition could increassed risk of retinal detachment that can cause blindness. Lattice degeneration is often found on myopic eyes with increases axial length. This study is aimed to evaluate the relationship and risk ratio between lattice degeneration with axial length and myopia among Samarinda college students. This was a cross-sectional study through purposive sampling. All subject underwent ophthalmologic examination including refractive correction, IOLmaster and indirect ophthalmoscopy by an ophthalmologist. A total of 66 myopic eyes were studied. Lattice degeneration was significantly associated with axial length (P=0.002) and myopia degree (P=0.001). Lattice degeneration was more common in high myopia (69,2%) and in axial length >26 mm (68,76%). Increasing lattice degeneration was associated with high myopia (OR:2,754, P=0.026) and axial length (OR:2.290, P=0.278). Conclusion: high myopia and axial length can increase the risk of lattice degeneration.

***Keywords**: Axial length, Lattice degeneration, Myopia degree*

1. INTRODUCTION

Lattice degeneration is an abnormal condition of the peripheral retina caused by stretching of the retina and the choroid which can lead to a thinning of the peripheral retina layer (Flaxel et al., 2019). It's peripheral retina degeneration can characterized by retinal thinning, overlying vitreous liquefaction, and firm vitreoretinal adhesions at the margins of thinning. In areas of lattice degeneration, retinal holes are also commonly found (Bedi & Shah, 2019; Flaxel et al., 2019). According to the American Academy of Ophthalmology (2019), lattice degeneration is one of the most common peripheral retinal degenerations with a prevalence of 6-8% from the general population. Similar studies were also reported by Zhang et al (2018) in China and by Siyal (2013) in Japan with prevalences of 4,5 % and 9,5%, respectively. In Indonesia, there is still no study about the prevalence of lattice degeneration.

Lattice degeneration are more common in myopic eyes, especially high myopic (Bedi & Shah, 2019; Chen et al., 2018; Rani et al., 2014). According to prospective studies conducted in India, around 42% of myopia patients showed peripheral degeneration with lattice degeneration being the most common with 19% (Akbani et al., 2014). Another study also suggested that myopia was associated with increased prevalence of peripheral retinal changes, like lattice degeneration (51%) in asian adults in Hong Kong (Chen et al., 2018). Myopia or high myopia is significantly associated with elongation of axial length (AL), and both is associated with visual impairment (Tideman et al., 2016).

High myopia is defined as a spherical equivalent (SE) of -6 D or worse, generally corresponds to axial length ≥26 mm (Tideman et al., 2018). A study by Chen et al (2018) exhibited that patients with myopia tended to experience elongation in axial length. Elongation or increased axial length toward the posterior retina in myopic eyes can lead to stretching and thinning retinal layers, especially the posterior (Nakkella & Supriya, 2021; Tideman et al., 2016). This can cause retinal holes or lattice degeneration with holes. An increase of one millimeter in axial length is associated with 28% increased risk of Lattice Degeneration, 44% increased risk of peripheral retinal hole and 25% increased risk of having any peripheral retinal change (Bedi & Shah, 2019; Chen et al., 2018).

Lattice degeneration is an asymptomatic disease which can make a lot of sufferers unaware of their situation. Nevertheless, lattice degeneration increases the risk of retinal detachment especially in patients with myopia and long axial length (Tsai et al., 2019; Zhang et al., 2018). Hence, it is important to have the awareness to perform routine checkups in order to prevent complications that can lead to retinal detachment (Wilkinson, 2014). The purpose of this study was to understand the risk of lattice degeneration in myopic patients with elongation in axial

length in Samarinda, Kalimantan Timur, Indonesia.

2. METHOD

This was a cross-sectional study through purposive sampling. This study was conducted in the Samarinda Eye Clinic (SMEC), Samarinda, Kalimantan Timur. Sampling was performed according to inclusion and exclusion criteria was patients with myopia aged 20 - 50 years, no history of trauma or intraocular surgery, and no history of turbidity in refractive media. In this study, myopia was divided into three groups which were mild (< -3 D), moderate (-3 to -6 D), and high (> -6 D) while axial length was divided into two groups which are group I (<26,00 mm) and group II (≥26,00 mm).

This study had 66 myopic eyes from 35 patients with informed consent in advance. Every patient was examined in refraction correction to see their degree of myopia and in axial length using IOL master and indirect ophthalmoscopy to see lattice degeneration. Each of these examinations were performed by ophthalmologists.

Data analysis performed in this study was chi-square and logistic regression to see association and how big were the risk factors of myopic eyes and elongation axial length towards lattice degeneration. Data analyses were conducted using SPSS software.

3. RESULTS

Based on analyses conducted, we obtained samples of 66 eyes from 35 myopic patients with an age range of 20-50 years and average age of 24,8 years ± 6,25 standard deviation (SD). fourty seven eyes (71,2%) from 25 female and 19 eyes (28,8%) from 10 men were the subjects of this study. Out of 66 myopic eyes, lattice degeneration was found in 24 eyes in this study or 36,4%.

Based on age, our study found that the age of 21 was the most common age group with 23 out of 66 eyes (34,8%) and lattice degeneration was most common in patients with the age of 21 years old with 8 eyes out of 24 cases (33,3%) of lattice degeneration (figure 1).

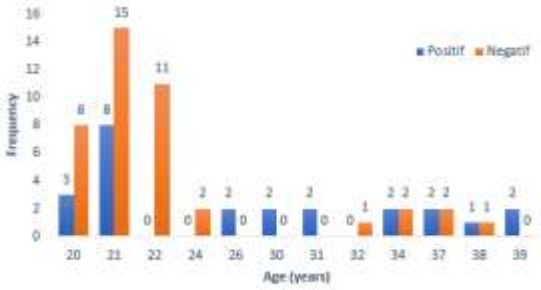

Figure 1. Age Frequency in lattice degeneration

Based on gender, we discovered that female patients were more frequent compared to male patients. However, lattice degeneration prevalence in male and female patients were similar with 36,2% and 36,8%, respectively (table 1).

Table 1. Characteristics Gender on lattice degeneration

Gender	Lattice degeneration		Total
	Positif	Negatif	

	n (%)	n (%)	
Female	17(36,2)	30 (63,8)	47
Male	7 (36,8)	12 (63,2)	19
Total	24 (36,4)	42 (63,6)	66

Myopia patients were divided into three groups which are mild (< -3 D), moderate (-3 to -6 D), and high (> -6 D). Among 66 myopic eyes, as much as 32 eyes (48,5%) were in the mild myopia with a range of -0,25 D to -2,5 D and a mean refraction of -1,55 D ± 0,656 SD, 21 eyes (31,8%) were in the moderate myopia -3 to -6 D with a mean refraction of -4,40 D ± 1,085 SD, and 13 eyes (19,7%) were in the high myopia with a range of -6,5 to -20 D and a mean refraction of -9,19 D ± 4,837 SD. Axial length was divided into two groups which were group I (< 26 mm) and group II (≥ 26 mm). Fifty eyes (75,8%) belonged in group I with 23,15 mm – 25,87 mm with mean axial length 24,76 mm ± 0,701 SD and 16 eyes (24,2%) belonged in group II with 26.09 mm - 30.01 mm with mean axial length 26,98 mm ± 1,001 SD.

Table 2. Characteristics of myopia degree and axial length

	Number of eyes	Range	Mean	Percentage (%)
Myopia				
Mild	32	-0,25 to -2,5 D	-1,55 D ± 0,65	48,5
Moderate	21	-3 to -6 D	-4,40 D ± 1,08	31,8
High	13	-6,5 to -20 D	-9,19 D ± 4,83	19,7
Axial length				
< 26 mm	50	23.15 - 25.87 mm	24,76 mm ± 0,701	75,8
≥26 mm	16	26.09 - 30.01 mm	26,98 mm ± 1,001	24,2

Out of 66 myopic eyes, lattice degeneration was found in 24 eyes in this study or 36,4%. Lattice degeneration was found in 15,6% (5 of 32 eyes) of mild myopic eyes, 47,6% (10 of 21 eyes) of moderate myopic eyes, and 69,2% (9 of 13 eyes) of high myopic eyes. In relationship with axial length, lattice degeneration was found in 26,0 % (13 of 50 eyes) of group I (<26 mm) and in 68,8% (11 of 16 eyes) of group II (≥26 mm). Analysis results using crosstabs tabulation showed that lattice degeneration was significantly associated with myopia degree (p=0.001) and axial length (p=0.002).

Lattice degeneration was most commonly found in patients with high myopia with 9 out of 13 eyes (69,2%) and axial length group II (≥26 mm) is 68,8%. Highly myopic eyes with lattice degeneration had significantly longer axial length with axial length of 25,26 - 30,01 mm (p <0.001). Analysis using logistic regression showed that risk of lattice degeneration increased as much as 2,7 times in high myopic eyes (p=0,026) and as much as 2,3 times in myopia with axial elongation ≥26 mm (p=0,278). These analyses showed the degree of myopic

eyes had a significant influence on lattice degeneration, while axial length did not have a significant effect on lattice degeneration.

Table 3. Percentage of lattice degeneration in various groups of myopia degree and axial length

		Lattice degeneration	
		Number of eyes	Percentage (%)
Myopia degree	Mild	5	15.6
	Moderate	10	47,6
	High	9	69,2
Axial Length	< 26 mm	13	26,0
	≥26 mm	11	68,8

Table 4. logistic regression analysis between lattice degeneration with axial length and myopia.

	OR (95% CI)	p-value
Axial length	2.290 (0,513, 10,235)	0.278
Myopia	2.754 (1.128, 6.720)	0,026

4. DISCUSSION

This is a cross sectional study on myopia cases in Samarinda, Kalimantan Timur. Our study found that lattice degeneration occurred in 36,4% of myopic eyes. This result was higher compared to the prevalence of lattice degeneration in the global scale and in previous studies. According to the American Academy of Ophthalmology on Flaxel et al (2019), prevalence of lattice degeneration in global population was 6-8%, while previous studies like the one performed by Rani et al (2014) and Chen et al (2018) showed that lattice degeneration occurred in myopic eyes with prevalence of 11,3% and 16,9%, respectively. Meanwhile in Indonesia, there was not yet a study about the prevalence of lattice degeneration.

Lattice degeneration can affect all age and sex groups (Nakkella & Supriya, 2021). A study by Venkatensen et al (2015) found that lattice degeneration can happen from the age of less than 10 years to more than 61 years. In this study however, lattice degeneration was most common in 21 years old patients with a prevalence of 33,3%. This result was in line with research conducted by Rani et al (2014) and Dahvoma et al (2016) that showed that ages between 20 to 30 years old had the highest prevalence of lattice degeneration with 16,5% and 37,8%, respectively. This is closely related to the high prevalence of myopia in ages of 20 to 29 years which increases the risk of peripheral retinal degeneration, especially lattice degeneration (Dohvoma et al., 2016; Pan et al., 2012). Furthermore, in ages older than 50 years, peripheral retinal atrophy is more common compared to other degeneration (Zhang et al., 2018).

Based on gender, our study showed that there was no significant difference of lattice degeneration prevalent between male and female patients with 36,2% and 36,8%, respectively. This result was different with the research performed by Rani et al (2014) which showed that more female (12,4%) suffered lattice degeneration compared to men (10%). Venkatesan et al (2015) also obtained similar result with higher prevalence of lattice degeneration in female (56,4%) compared to men (43,47%). However, in both of those studies gender did not have significant association to lattice degeneration.

High myopia and axial length were the most important factors in the

formation of lattice degeneration (Dohvoma et al., 2016; Tideman et al., 2016). In this study, the majority of myopia was mild myopia (< -3D) with 48,5%, followed by moderate myopia (-3 to -6D) with 31,8%, and high myopia (> -6D) with 19,7%. Based on axial length, axial length group 1 was the majority with 75,8% followed by group 2 with 24,2%.

Even though mild myopia and axial length group 1 were the majority groups in this study, lattice degeneration was most common in high myopia with 9 out of 13 eyes (69,2%, p = 0,001) and in axial length group 2 with 11 out of 16 eyes (68,8%, p=0,002). This result was in line with research done by Chen et al (2018) and Rani et al (2014) which exhibited that lattice degeneration was most prevalent in high myopia with axial length > 26 mm. The study conducted by Nakkella & Supriya (2021) showed that axial lengths of myopic eyes with lattice degeneration were in the range of 29,02-33,31 mm. However, this study's results were different with Siyal et al (2013) which indicated that 21,4% of lattice degeneration occurred in eyes with axial length of 24,01-26,00 mm and 9,6% occurred in eyes with axial length of 26,01-28,00 mm. This difference might be caused by the dissimilarity of measurement method used in Siyal et al (2013) compared to our study. They used A-scan ultrasonografi for axial length measurement, while this study used the IOL master method which was the newest standard of measurement method.

Myopia could be caused by a defect of refraction or an elongation of axial length (Ilyas & Yulianti, 2015). However, recent studies stated that increases of axial lengths, especially above average which is 24 mm, were found in the majority of myopia cases, especially high myopia (Jagadeesh et al., 2020; Nakkella & Supriya, 2021; Tideman et al., 2018). Likewise, our study found that high myopia is significantly associated with axial length increase (p<0,001). Elongation of axial length to anteroposterior direction can cause mechanical strain, vascular changes, stretching, and thinning of the posterior pole, such as sclera, choroid, and retina (Jagadeesh et al., 2020). These stretching and thinning will lead to a decrease of blood supply to the retina which can cause an impairment of retinal function, especially that of peripheral retina. (Eva & Witcher., 2013). Even though the pathology of lattice degeneration is still unknown, the stretching and thinning of retinal layer which are caused by increased axial length on myopic eyes are in fact, the causes of lattice degeneration (Akbani et al., 2014; Bedi & Shah, 2019).

Lattice degeneration is the most common peripheral retinal degeneration known today. It is common in myopic patients, especially high myopic ones (Nakkella & Supriya, 2021). This is related to the fact that increased axial length in myopia leads to stretching and thinning of the retina and choroid, which give rise to tessellated fundus and peripheral retinal degenerations (Bedi & Shah, 2019). Lattice degeneration can cause asymptomatic retinal holes, risk of retinal tears, and risk of retinal detachment (Jones & Luensmann, 2012; Venkatesan et al., 2015; Wilkinson, 2014). A study conducted by Bedi & Shah (2019) showed that lattice degeneration in myopia patients was the primary cause of retinal

detachment (21,7%). Prospective study performed by Ho & Ho (2015) indicated that lattice degeneration increased the risk of retinal detachment to four times higher compared to normal population.

Logistic regression was used to calculate odds ratio for lattice degeneration by myopia and axial length categories in this study. The results showed that the risk of lattice degeneration increased as much as 2,754 times in high myopic eyes and as much as 2,290 times in myopia with axial elongation more than 26 mm. These results agreed with the research done by Tideman et al (2016) which indicated that eyes with axial length of 26 mm or greater had as much as 2 to 11 times higher risk of visual impairment compared to eyes with axial length less than 24 mm. Chen et al (2018) also stated that 1 millimeter increase of axial length magnify the risk of lattice degeneration by 28% and the risk of retinal hole by 44%. Furthermore, the risk of visual impairment was also strengthened by Tideman's (2018) research which stated that the increase of axial length on individuals every year is directly proportional to the increase of high myopia cases, which is significantly associated with elongation of axial length. Both high myopia and elongation of axial length are associated with visual impairment (Tideman et al., 2016). Hence, patients with high myopia or with axial length more than 26 mm should perform routine eye check up to detect early signs of visual impairment, as well as lattice degeneration.

5. CONCLUSIONS AND SUGGESTIONS

Lattice degeneration was found to be significantly associated and was mainly found in high myopia and axial length of ≥ 26 mm. Highly myopia with lattice degeneration had significantly longer axial length. Logistic regression analysis in this study showed that the higher myopia degree and axial length, the higher the risk of lattice degeneration.

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