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# THE RELATIONSHIP BETWEEN DIABETIC RETINOPATHY DEGREE WITH VISUAL ACUITY AND RETINAL NERVE FIBER LAYER THICKNESS IN TYPE 2 DIABETES MELLITUS PATIENTS

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## ABSTRACT

**Introduction.** Diabetic retinopathy is an ocular complication of diabetes mellitus (DM), and is one of the leading causes of visual impairment and blindness worldwide.. More than one third of people with diabetes have signs of diabetic retinopathy. **Methods.** This was an analytic observational study with cross-sectional design. The sample was type 2 diabetes mellitus patients with diabetic retinopathy who visited the eye clinic at the University of Sumatera Utara General Hospital from September 2021-December 2021. The sample were then analyzed with the Mann-Whitney and Kruskal Wallis test to find the relationship between diabetic retinopathy degree with visual acuity and retinal nerve fiber layer thickness in type 2 diabetes mellitus patients. **Results.** The sample of this study were 20 subjects with diabetic retinopathy and 20 subjects without diabetic retinopathy as the control group. The mean visual acuity in subjects with mild diabetic retinopathy was 0.65±0.48. Average visual acuity in subjects with the degree of moderate diabetic retinopathy was 0.83±0.46. The mean visual acuity in subjects with a proliferative degrees diabetic retinopathy was 0.77±0.64. Mann Whitney test revealed no statistically significant relationship between the degree of diabetic retinopathy and visual acuity (p=0.734). Using the Kruskal Wallis test revealed that there was no significant relationship between the degree of retinopathy diabetic with Avg RNFL (p=0.495), superior RNFL (p=0.385), inferior RNFL (p=0.111), temporal RNFL (p=0.064), nasal RNFL (p=0.535). **Discussion.** Controlling blood glucose levels becomes more important than the duration of diabetes in preventing the development of retinopathy. Most patients are advised to have an HbA1c of 7% or lower, and for certain patients it is recommended to be lower than 6.5%. Diabetic retinopathy slowly damages the retinal blood vessels or the optic nerve layer, leading to leakage, thus resulting in accumulation of fluid containing lipid and blood in the retina which will gradually lead to visual impairment, and even blindness. **Conclusion.** There is no significant relationship between diabetic retinopathy degree with visual acuity and retinal nerve fiber layer thickness in type 2 diabetes mellitus patients.

**Keywords:** Diabetic Retinopathy, Diabetes Mellitus, Retinal Nerve Fiber Layer

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## INTRODUCTION

Diabetes Mellitus (DM) is the most common chronic disease in the world. Diabetic retinopathy is an ocular complication of DM contributing to visual impairment and blindness globally [1][2]. More than one-third of people with diabetes have diabetic retinopathy. Patients with visual impairment caused by diabetic retinopathy are also known to increase from 1.4 million people in 1990 to 2.6 million people in 2015 [3][4].

Based on the epidemiology study conducted in America, the prevalence of diabetic retinopathy into two groups: young onset and old onset [5]. Young onset are patients diagnosed with diabetes before age 30 years old with insulin therapy and old onset are patients diagnosed with diabetes after 30 years old. Several risk factors that influence diabetic retinopathy include gender, age and duration of diabetes. Based on the study, in patients under 30 years old, proliferative events were more common in men than in women. Meanwhile, in patients over 30 years old, no significant difference in the incidence or progression between men and women [5][6]. In correlation with increasing type 2 diabetes mellitus (T2DM) patients, the incidence of retinopathy also increased with increasing age. Research conducted by Mulyati et al. in Palembang, the frequency of diabetic retinopathy patients in the age category 31-45 years was 11.60%, 46-58 years was 69.80%, and 59-71 years was 18.60%. From research by Suryathi conducted at three hospitals in Denpasar, the proliferative diabetic retinopathy (PDR) group showed the frequency of male was 52.70% and females was 47.30% [7].

Duration of diabetes is the strongest factor in the incidence of retinopathy The retina decreases anabolic activity to reduce energy requirements and maintain retinal nerve life in diabetic conditions. Retinopathy can not be detected clinically at this stage and vision is still good [8][9]. A patient can be classified without retinopathy until lesions such as: microneurysms or exudates, and when there is significant blood flow disturbance indicated as an early sign of retinal dysfunction in diabetes [10]. Microvascularly, hypoperfusion resulting from endothelial damage causes the growth of new blood vessels that are fragile and prone to leaking. Impaired blood-retinal barrier integrity results in fluid extravasation and inflammatory mediators causes vision-threatening retinal edema and worsen the inflammation [11]. After 5 to 10 years, adaptive changes begin to fail and show early signs of decompensation clinically recognized as non-proliferative diabetic retinopathy (NPDR) [12].

Several studies revealed that neurodegenerative retinal changes occured earlier than microvascular changes. Retinal nerve fiber layer thickness measurement can detect neurodegeneration at an early stage [7]. A meta-analysis of DM patients showed evidence of significant retinal nerve fiber layer (RNFL) thinning. Paul et al. in their research stated that the higher the glucose level in the blood correlated to the thinner RNFL [13][14].

The hyperglycemia condition in DM can cause various changes at the cellular level before the manifestations of diabetic retinopathy begin to appear [15]. Reactivity of glial cells, high levels of extracellular glutamate, oxidative stress, induction of the renin-angiotensin system, increased levels of advanced glycation end products (AGEs), high levels of pro-apoptotic factors, as well as an imbalance of retinal neuroprotective factor production has a role in the occurrence of retinal neurodegenerative conditions due to DM through the induction of cell apoptosis. Retinal ganglion cell apoptosis can cause a decrease in retinal ganglion cell layer and the RNFL layer thickness [16]. Retinal neurodegeneration, such as apoptosis retinal neuron cells and peripapillary nerve layer thinning, have an essential role in the pathogenesis of diabetic retinopathy. Axons from retinal ganglion cells form the RNFL and form the optic nerve that connects the eyeball to the brain. Optic nerve head microcirculation is essential for maintaining the physiologic pathway of vision. RNFL gets some its nutrition from the radial peripapillary capillaries originating from the peripapillary branches of the adjacent retinal arteries [17].Impaired blood flow or microvascular dysfunction can affect RNFL or ganglion cell function. Histological and clinical studies suggest that the radial peripapillary capillaries have an critical role in important in the area of arcuate fibers. Pathological changes such as Bjerrum scotoma, intraretinal hemorrhae, cotton wool spot, optic neuropathy ischemia, may have consistent nerve damage with the radial peripapillary capillary [18]. Microvascular changes in the optic nerve head are one of the important signs of preclinical diabetic retinopathy [19]. Spectral domain optical coherence Tomography (SD-OCT) is a non-invasive imaging technology that can detect the loss of retinal nerve tissue by measuring RNFL thickness with high resolution image that facilitate early diagnosis. Oshitari et al. study showed that peripapillary retinal nerve layer thickness was decreased in patients with early-stage diabetic retinopathy compared to normal patients without diabetic retinopathy [20].

## MATERIALS AND METHODS

This was an analytic observational study with cross sectional design conducted at the Vitreo-Retina division of the Eye Clinic of University of Sumatera Utara General Hospital. The study population was all patients with type 2 diabetes mellitus with diabetic retinopathy who visited the eye clinic at University of Sumatera Utara General Hospital from September 2021-December 2021. The research sample was type 2 DM patients with diabetic retinopathy who visited the eye clinic at the University of Sumatera Utara General Hospital from September 2021-December 2021 that meet the criteria .

The study population was patients with type 2 diabetes mellitus with diabetic retinopathy who visited the eye clinic at the University of Sumatera Utara General Hospital from September 2021-December 2021. The control of the study were patients with type 2 diabetes mellitus without diabetic retinopathy who visited the eye clinic at the University of Sumatera Utara General Hospital from September 2021-December 2021.

Inclusion criteria in this study were patients who visited the eye clinic at the University of Sumatera Utara General Hospital who were diagnosed with T2DM by an Internist, patients diagnosed with diabetic retinopathy, patient aged more than 30 years old, had clear refractive medium and patients who are willing to participate in the study.

Exclusion criteria in this study were patients with anterior segment abnormalities, patients with elevated intraocular pressure (IOP), patients diagnosed with glaucoma or with family history of glaucoma, patients with a history of orbital tumors, patients with a history of eye surgery, patients receiving an injection of anti-vascular endothelial growth factor (VEGF), and patients with history of laser therapy.

Mann Whitney and Kruskal Wallis test was used to find the relationship between diabetic retinopathy degree with visual acuity and retinal nerve fiber layer thickness in type 2 diabetes mellitus patients.

## RESULT

This study consisted of 40 patients with a diagnosed with type 2 DM who visited Vitreo-Retina Division from the Eye Clinic of the University of Sumatera Utara General Hospital. Population were divided into two groups with a total of 20 subjects in each group: subjects with diabetic retinopathy and subjects without diabetic retinopathy.

**Table 1. Characteristics of Research Subjects**

| Subject Character | RD (n=20) | | | | p |
|---|---|---|---|---|---|
| | Mild NPDR | Moderate NPDR | PDR | Non DR | |
| Gender, n (%) | | | | | |
| Man | 6 (75) | 8 (88.9) | 1 (33.3) | 8 (40) | 0.065[a] |
| Woman | 2 (25) | 1 (11.1) | 2 (66.7) | 12 (60) | |
| Age, n(%) | | | | | |
| < 45 years | 1 (12.5) | 0 | 0 | 1 (5) | 0.706[b] |
| 45 – 65 years | 7 (87.5) | 5 (55.6) | 3 (100) | 16 (80) | |
| > 65 years | 0 | 4 (44.4) | 0 | 3 (15) | |
| Length of Suffering from DM, years | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Mean±SD<br>Median (Min-Max) | 9.13±2,53<br>8 (7-15) | 15.33±2,65<br>15 (12-20) | 6.33±1.53<br>6 (5-8) | 8.3±2,41<br>8 (6-15) | <0.001[b] |
| HbA1c, % | | | | | |
| Mean±SD<br>Median (Min-Max) | 10.91±1.99<br>12 (8-12,5) | 9.97±3.09<br>8 (7-13.9) | 10.6±3.4<br>10.8 (7.1-13.9) | 10.22±2.71<br>9,7 (6-14,4) | 0.849[b] |

Subjects in the group with diabetic retinopathy were mostly male with total of 15 patients; 6 patients had mild NPDR, 8 patients with moderate NPDR and 1 patients with PDR. Meanwhile, most of the patients were female in the control group with 12 subjects (60%).

Most patients were in the group of 45-65 years old, seven patients with mild NPDR, five patients with moderate NPDR and three patients with PDR. Meanwhile, the control group consisted of most patients aged between 45-65 years.

The mean duration of having DM in the group of patients with mild NPDR was 9.13 years, with moderate NPDR was 15.33 years and with PDR was 5.33 years. In the control group, the average duration of diabetes was 8.3 years.

The average HbA1c value in patients with mild NPDR was 10.91, with moderate NPDR 9.97 and with PDR 10.6. In the control group, the average HbA1c level was 10.22.

**Table 2. Results of Visual Examination in Subjects with Diabetic Retinopathy and Subjects Without Diabetic Retinopathy**

| Visual Acuity | Diabetic Retinopathy (n=20) | Non Diabetic Retinopathy (n=20) | p |
|---|---|---|---|
| **Visual Acuity OD** | | | |
| Mean±SD | 0.72±0.53 | 0.38±0.32 | 0.068 |
| Median (Min–Max) | 0.5 (0–1.8) | 0.4 (0–1) | |
| **Visual Acuity OS** | | | |
| Mean±SD | 0.79±0.56 | 0.6±0.52 | 0.385 |
| Median (Min–Max) | 1 (0–2,5) | 0.4 (0–1.8) | |

Table 2 showed the results of the right eye visual acuity examination in subjects with diabetic retinopathy and subjects without diabetic retinopathy in the right and left eyes. The mean visual acuity of the right eye in subjects with diabetic retinopathy was 0.72±0.53 while in the control group was 0.38±0.32.

Mann Whitney test showed there was no difference in mean visual acuity in the right eye between subjects with diabetic retinopathy and the control group (p=0.068).

The mean visual acuity in left eye from subjects with diabetic retinopathy was 0.79±0.32, and mean visual acuity in the control group was 0.6±0.52. Mann Whitney test showed that there was no difference in mean visual acuity from the left eye between subjects with diabetic retinopathy and the control group (p=0.385).

**Table 3. RNFL Examination Results**

| | **Diabetic Retinopathy (n=20)** | **Non Diabetic Retinopathy (n=20)** | **p** |
|---|---|---|---|
| **Avg RNFL** | | | |
| Mean±SD | 107.65±23.04 | 108.91± 13.45 | 0.605 |
| Median (Min–Max) | 107.5 (64–174) | 108 (86–150) | |
| **Superior** | | | |
| Mean±SD | 127.1±27.64 | 125.91±22.17 | 0.395 |
| Median (Min–Max) | 125 (92–176) | 119 (92–171) | |
| **Inferior** | | | |
| Mean±SD | 127.1±27.64 | 125.91±22.17 | 0.895 |
| Median (Min–Max) | 125 (92–176) | 119 (92–171) | |
| **Temporal** | | | |
| Mean±SD | 81.25±27.15 | 79.94±19.14 | 0.951 |
| Median (Min–Max) | 79.5 (42–169) | 79 (43 – 151) | |
| **Nasal** | | | |
| Mean±SD | 99.5±28.81 | 103.49±23.65 | 0.993 |
| Median (Min–Max) | 106 (22–147) | 102 (71–145) | |

Table 3 showed the results of the RNFL examination in subjects with diabetic retinopathy and control group. Using the Mann Whitney test showed that there was no differences in Avg RNFL, superior RNFL, inferior RNFL, temporal RNFL and nasal RNFL between subjects with diabetic retinopathy and the control group ($p > 0.05$).

**Table 4. The Relationship of Retinopathy Degree with Visual Acuity**

| **Degree of diabetic retinopathy** | **Visual Acuity** | | **p** |
|---|---|---|---|
| | **Mean (SD)** | **Median (Min-Max)** | |
| **Mild** | 0.65±0.48 | 0.5 (0–1.5) | **0.734*** |
| **Moderate** | 0.83±0.46 | 1 (0.4 – 1.8) | |
| **Proliferative** | 0,77±0.64 | 0.4 (0.4–1.5) | |

*Kruskal Wallis

Table 4 showed the relationship between the degree of retinopathy and visual acuity. Mean visual acuity in subjects with mild diabetic retinopathy was 0.65±0.48, mean visual acuity in subjects with moderate diabetic retinopathy was 0.83±0.46, and mean visual acuity in subjects with proliferative diabetic retinopathy was 0.77±0.64. Kruskal Wallis test showed that there was no significant relationship between the degree of diabetic retinopathy and visual acuity (p=0.734).

**Table 5. Relationship of Retinopathy Degree with Avg RNFL**

| Degree of diabetic retinopathy | *Avg RNFL* | | p |
|---|---|---|---|
| | Mean±SD | Median (Min-Max) | |
| **Mild** | 107.75±19 | 105.5 (81–139) | 0.495 |
| **Moderate** | 111.56±28.68 | 111 (64–174) | |
| **Proliferative** | 95.67±14.22 | 89 (86–112) | |

Table 5 showed the relationship between the degree of retinopathy and Avg RNFL. The mean Avg RNFL in subjects with mild diabetic retinopathy was 107.75±19. The mean Avg RNFL in subjects with moderate diabetic retinopathy was 111.56±28.68. The mean Avg RNFL in subjects with proliferative diabetic retinopathy was 95.67±14.22. Kruskal Wallis test showed that there was no significant relationship between the degree of diabetic retinopathy and Avg RNFL (p=0.495).

**Table 6. Relationship Degree of Retinopathy with Superior RNFL**

| Degree of diabetic retinopathy | Superior *RNFL* | | p |
|---|---|---|---|
| | Mean±SD | Median (Min-Max) | |
| **Mild** | 124.63±22.14 | 126 (81 – 152) | 0.385* |
| **Moderate** | 137.89±33.79 | 124 (112 – 204) | |
| **Proliferative** | 101±26.63 | 98 (76 – 129) | |

*Kruskal Wallis

Table 6 showed the relationship between the degree of retinopathy and superior RNFL. The mean superior RNFL in subjects with mild diabetic retinopathy was 124.63±22.14. The mean superior RNFL in subjects with moderate diabetic retinopathy was 137.89±33.79. The mean superior RNFL in subjects with proliferative diabetic retinopathy was 101±26.63. Kruskal Wallis test showed that there was no significant relationship between the degree of diabetic retinopathy and superior RNFL (p = 0.385).

**Table 7. Relationship of Retinopathy Degree with Inferior RNFL**

| Degree of diabetic retinopathy | Inferior *RNFL* | | p |
|---|---|---|---|
| | Mean±SD | Median (Min-Max) | |
| Mild | 123.38± 30.6 | 111 (92 – 170) | 0.111* |
| Moderate | 137.89±23.66 | 128 (112 – 176) | |
| Proliferative | 104.67±20.23 | 94 (92 – 128) | |

*Kruskall Wallis

Table 7 showed the relationship between the degree of retinopathy and Inferior RNFL. The mean inferior RNFL in subjects with mild diabetic retinopathy was 0.65±0.48. The mean inferior RNFL in subjects with moderate diabetic retinopathy was 0.83±0.46. The mean inferior RNFL in subjects with proliferative diabetic retinopathy was 0.77±0.64. Kruskal Wallis test showed that there was no significant relationship between the degree of diabetic retinopathy and inferior RNFL (p=0.111).

**Table 8. Relationship of Retinopathy Degree with Temporal RNFL**

| Degree of diabetic retinopathy | Temporal *RNFL* | | p |
|---|---|---|---|
| | Mean±SD | Median (Min-Max) | |
| Mild | 83±23.65 | 82 (42 – 128) | 0.064* |
| Moderate | 87.33±31.6 | 82 (65 – 169) | |
| Proliferative | 58.33±9.07 | 62 (48 – 65) | |

*Kruskal Wallis

Table 8 showed the relationship between the degree of retinopathy and the temporal RNFL. The temporal mean RNFL in subjects with mild diabetic retinopathy was 83±23.65. The temporal mean of RNFL in subjects with moderate diabetic retinopathy was 87.33±31.6. The temporal mean of RNFL in subjects with proliferative diabetic retinopathy was 58.33±9.07. Using the Kruskal Wallis test showed that there was no significant relationship between the degree of diabetic retinopathy and temporal RNFL (p = 0.064).

**Table 9. Relationship of Retinopathy Degree with Nasal RNFL**

| Degree of diabetic retinopathy | Nasal *RNFL* | | p |
|---|---|---|---|
| | Mean (SD) | Median (Min-Max) | |
| Mild | 92.75±35.36 | 96 (22 – 126) | 0.535* |
| Moderate | 99.11±26.2 | 90 (71 – 147) | |

| | | |
|---|---|---|
| **Proliferative** | 118.67±5.51 | 116 (115 – 125) |

*Kruskal Wallis

Table 9 showed the relationship between the degree of retinopathy and nasal RNFL. The mean nasal RNFL in subjects with mild diabetic retinopathy was 92.75±35.36. The mean nasal RNFL in subjects with moderate diabetic retinopathy was 99.11±26.2. The mean nasal RNFL in subjects with proliferative diabetic retinopathy was 118.67±5.51. Kruskal Wallis test found that there was no significant relationship between the degree of diabetic retinopathy and nasal RNFL (p=0.535).

## DISCUSSION

This study was an analytic observational with a cross sectional design on type 2 DM patients diagnosed with diabetic retinopathy and without diabetic retinopathy at the Eye Clinic of the University of Sumatera Utara General Hospital. This study aims to find the relationship between the diabetic retinopathy degree with visual acuity and RNFL thickness in patients with type 2 diabetes mellitus.

This study produced characteristic data and analyzed of study subjects that can provide information, support, or refute the theories that have been known from previous studies regarding visual acuity and RNFL thickness associated with diabetic retinopathy degree in T2DM patients. Subjects of this study were 40 patients who came to the Eye Clinic of the University of Sumatera Utara General Hospital and met the inclusion and exclusion criteria.

From Table 1, subjects in the group with diabetic retinopathy were mostly male, totaling 15 patients, of which 6 patients had mild NPDR, 8 patients with moderate NPDR and 1 patients with PDR. Meanwhile, in the control group, most of the patients were women with 12 patients (60%). This result was similar to Suryathi's study conducted at three hospitals in Denpasar, the frequency of male was 52.70% while female was 47.30%. However, based on Suryathi's research, the frequency of PDR was more in male than female. Based on the WSDR, proliferative events were more common in men than in women in subjects under 30 years old, however no significant difference in the progression of retinopathy was found. Meanwhile, no significant difference was found in incidence and progression between male and female in subjects over 30 years old. Similarly, in this study, no significant difference was found [5][6].

Based on age, most patients were in the 45-65 age group, with 7 patients with mild NPDR, 5 patients with moderate NPDR and 3 patients with PDR. Meanwhile, in the control group, most subjects were in 45-65 years age group. This study was similar with research conducted by Mulyati et al. in Palembang, the frequency of diabetic retinopathy patients in the 31-45 years age group was 11.60%, 46-58 years age group was 69.80%, and 59-71 years age group was 18.60%. Chen et al. study stated that in type 2 diabetes mellitus patients, the incidence of retinopathy increases with age [5].

The average duration of suffering from DM in the group of subjects with mild NPDR was 5.33 years, moderate NPDR 9.13 years and PDR with a mean of 15.33 years. In the control group, the average duration of DM was 8.3 years. This is similar with the study conducted by Rangkuti in Medan that most people suffered from DM for 7-12 years. In Suryathi study conducted at three hospitals in Denpasar showed that the average length of patients had diabetes in the NPDR group was 8.50±2.92 years and the PDR group was 9.72±3.92 years. The duration of diabetes is the most significant factor in the incidence of retinopathy. In type 2 diabetes, the prevalence of retinopathy is approximately 20% since diagnosis and increases to 60-85% after 15 years.

The mean value of HbA1c in the group of subjects with diabetic retinopathy was 10.44%, with the lowest level of 7% and the highest level of 13.9%. This study results were similar with the study by Valizadeh et al. and Zmen who found that HbA1c levels were associated with the incidence of diabetic retinopathy and increased the progression of diabetic retinopathy to PDR. If retinopathy has developed, controlling blood glucose levels became more important than the duration of diabetes in preventing the development of retinopathy. Most patients were advised to have an HbA1c of 7% or lower, and for certain patients was recommended to be lower 6.5% [8][10].

From table 2, mean visual acuity in subjects with mild diabetic retinopathy was 0.65±0.48. The mean visual acuity in subjects with moderate diabetic retinopathy was 0.83±0.46. The mean visual acuity in subjects with proliferative diabetic retinopathy was 0.77±0.64. Kruskal Wallis test showed no significant relationship between the degree of diabetic retinopathy and visual acuity ($p=0.734$). A total of 3.6% of patients under 30 years old and 1.6% over 30 years old had visual acuity of 20/200 or worse. This visual disturbance is caused by diabetic retinopathy in 86% of patients under 30 years old and 33% of patients over 30 years old. Sasongko et al. stated that in diabetic retinopathy, slow damage to the retinal blood vessels or the optic nerve layer led to leakage, resulting in a buildup of fluid (exudate) containing lipid and blood in the retina which would gradually led to visual impairment, and even blindness [11][16].

Using the Mann Whitney test showed that there were no differences in Avg RNFL, superior RNFL, inferior RNFL, temporal RNFL and nasal RNFL between subjects with diabetic retinopathy and control subjects ($p > 0.05$). In contrast to the study by Liu et al., significant correlation between vascular density and RNFL thickness in the mild NPDR group was found, but no significant relationship in the control group. This situation may because of shorter duration of DM without retinopathy in Liu's study,that was 3 years. El-Hifnawy et al. study found that there was no statistically significant difference in retinal nerve fiber layer (RNFL) thickness from each quadrant in eyes with baseline non proliferative diabetic retinopathy (NPDR) when compared to a healthy age-matched control group. Takis et al. study reveal thinner RNFL was found to in diabetics, but a 2-year follow-up did not show a significant

reduction in RNFL thickness in both diabetic and normal groups suggesting that RNFL breakdown may occur earlier in diabetic patients. The onset of diabetes causes RNFL depletion in the early stages, but good adherence to medication and glycemic control can minimize further RNFL damage. Changes in RNFL thickness were an early estimation of neurovisual damage. The clinical changes in retinopathy were usually irreversible sequelae. The changes seen in diabetic retinopathy were usually caused by microvascular damage, whereas neurodegenerative changes were difficult to detect clinically. Several studies had shown that neurodegenerative changes in the retina occur earlier than microvascular changes. Measurement of retinal nerve fiber layer thickness could detect neurodegeneration at an early stage. A meta-analysis of patients with diabetes mellitus showed evidence of significant RNFL depletion [20][24][30].

## CONCLUSION

Subjects in the group with diabetic retinopathy were mostly male, with a total of 15 patients; 6 patients had mild NPDR, 8 patients with moderate NPDR and 1 patients with PDR. Meanwhile, in the control group, most were female with 12 people (60%). Mostly patients were in 45-65 years old age group, 7 patients with mild NPDR, 5 patients with moderate NPDR and 3 patients with PDR. Meanwhile, in the control group as many as 16 patients were aged between 45-65 years. The average duration of suffering from DM in the group of subjects with mild NPDR was 9.13 years, moderate NPDR was 15.33 years and PDR was 5.33 years. In the control group, the average duration of DM was 8.3 years. The mean value of HbA1c in the group of subjects with mild NPDR was 10.91, with moderate NPDR was 9.97 and with PDR was 10.6. In the control group, the average HbA1c level was 10.22. The mean visual acuity in patients with mild diabetic retinopathy was $0.65 \pm 0.48$. The mean visual acuity in subjects with moderate diabetic retinopathy was $0.83 \pm 0.46$. The mean visual acuity in subjects with proliferative diabetic retinopathy was $0.77 \pm 0.64$. The Kruskal Wallis test showed no significant relationship between the degree of diabetic retinopathy and visual acuity ($p = 0.734$). Kruskal Wallis test revealed no significant relationship between diabetic retinopathy degree and Avg RNFL ($p=0.495$), superior RNFL ($p=0.385$), inferior RNFL ($p=0.111$), temporal RNFL ($p=0.064$), nasal RNFL ($p = 0.535$).

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