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RESEARCH

The Challenges of Handling Neovascular Glaucoma at Undaan Eye Hospital Surabaya, Indonesia

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Abstract

Introduction: Neovascular glaucoma (NVG) is a secondary glaucoma, frequently incurable, and can cause blindness. It is characterized by neovascularization over the iris, IOP elevation, and glaucomatous optic neuropathy. Retinal ischemia, which supplies the release of angiogenesis factors, is the leading factor of NVG. Anti-vascular endothelial growth factor (Anti-VEGF) agents are effective at iris and iridocorneal angle neovascularization. Furthermore, laser and surgery are still necessary to decrease intraocular pressure in the condition with ineffective medication. Delay in treatment can lead to sight-threatening glaucoma. **Purpose:** This study aimed to provide an overview of the incidence and management of NVG at Undaan Eye Hospital, Surabaya, Indonesia. **Methods:** This descriptive epidemiology study comprised 111 eyes of 102 patients. The inclusion criteria were patients diagnosed with NVG who came to Undaan Eye Hospital for one year (January 2021 to December 2021). Patients with incomplete medical records were excluded. The patient's age, gender, risk factors, and treatment were reviewed. **Results:** There were 102 patients (111 eyes) diagnosed with NVG. The patients were primarily men (53.2%), and the mean age was 54.98 ± 12.4 years. Diabetes mellitus (DM) was observed in 70 (63.1%) eyes, hypertension in 60 (54.1%) eyes, central retinal vein occlusion (CRVO) in 11 (9.9%) eyes, cholesterol in seven (6.3%) eyes, and branch retinal vein occlusion (BRVO) in one (0,9%) eye. The mean IOP at the time of diagnosis was 42.8 ± 11.2 mmHg. Anti-VEGF (25.2%), trabeculectomy (59.5%), glaucoma drainage device (17.1%), micropulse transscleral cyclophotocoagulation (5.4%) were done as an option of the treatment**. Conclusions:** NVG is more common in men. Most patients presenting NVG had DM and hypertension with a mean IOP of 42.8 mmHg. Trabeculectomy is the most commonly performed procedure.

Keywords: neovascular glaucoma (NVG); secondary glaucoma; intraocular pressure (IOP); trabeculectomy; anti-vascular endothelial growth factor

Introduction

Neovascular glaucoma (NVG) is a type of secondary glaucoma that is potentially blinding.[1],[2],[3] The prevalence of NVG is 0.12% in migrant Indians in Singapore and 0.01% in West Bengal, India.[1] Hospital-based study mentioned that approximately 9-17.4% of secondary glaucoma was NVG.[1] A study in Dr. Cipto Mangunkusumo Hospital reported that the prevalence of NVG among secondary glaucoma was 8%.[4] Although its prevalence is low, it can present significant visual loss and blindness.[1],[4]

NVG is characterized by neovascularization over the iris and iridocorneal angle, elevation of intraocular pressure (IOP), and glaucomatous optic neuropathy.[5],[6] It is caused by ocular and systemic conditions that contribute to retinal ischemia and initiate the release of angiogenesis factors.[1],[5] The most common causes of NVG are diabetic retinopathy, central retinal vein occlusion (CRVO), and central retinal artery occlusion (CRAO) of the carotid artery.[7],[8] Less commonly, it can be secondary to eye tumors, trauma, inflammation, and systemic conditions.[7],[8] According to the latest study[7], about 40-45% of patients with CRVO, 80% of them will develop NVG in just six to eight months. In addition, 65% of patients with proliferative diabetic

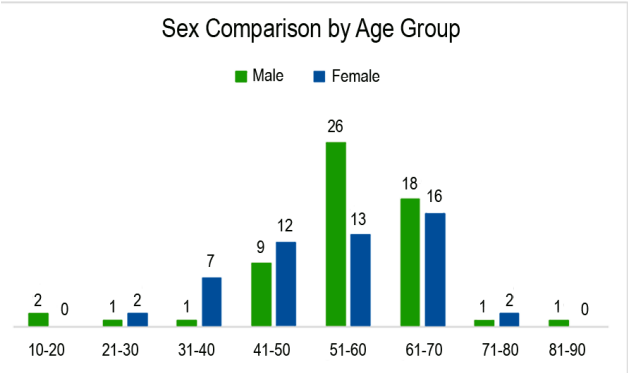

Figure 1. Sex comparison by age group.

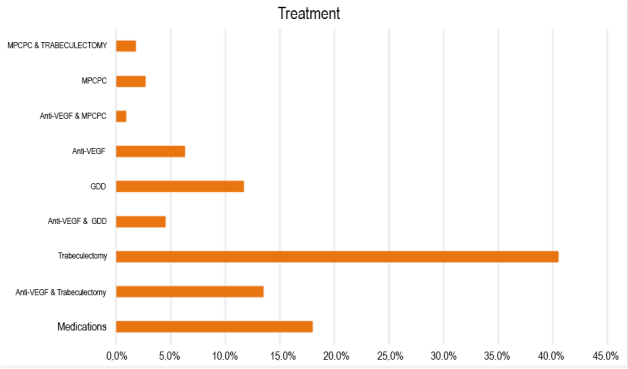

Figure 2. Medical intervention of NVG.

retinopathy (PDR) will present anterior segment new vessels, and NVG will appear in 20% of them.[7]

The key to successful management of NVG is the early identification of neovascularization, immediate treatment including management of retinal ischemia causes, treatment of retinal ischemia with pan-retinal photocoagulation (PRP) or intravitreal injection of anti-VEGF agents, decrease IOP with medication or surgery, and control of inflammation.[9] Studies have reported that anti-VEGF agents are effective at iris and angle neovascularization.[9],[10] Besides, in most cases, laser or surgery is still necessary.[10] Prompt and precise treatment of this condition may prevent vision-threatening glaucoma progression.

Methods

This study was a retrospective observational study. Data were taken from medical records of patients diagnosed with NVG who came to Undaan Eye Hospital Surabaya, Indonesia for one year (January 2021 to December 2021). Research data include gender, age, risk factor, IOP pre and post-treatment, and medical intervention. Ethical clearance had been received from the Ethical Committee for Health Research at Universitas Airlangga, Indonesia.

The subjects were patients who met the inclusion criteria. The inclusion criteria in this study were NVG patients undergoing treatment at the Undaan Eye Hospital from January 2021 to December 2021 and had IOP evaluation (mmHg) up to 6 months follow-up. Exclusion criteria in this study were patients with incomplete medical records and patients lost to follow-up before and after medical intervention.

All data obtained were analyzed with the IBM SPSS Statistics Version 27. Data on subject profiles were analyzed descriptively. Categorical scale data were described in terms of frequency and percentage.

Results

During the study period, a total of 111 eyes of 102 patients were diagnosed with NVG. Most subjects were between 51 and 60 years old (35.1%), while fewer were under 20 years (1.8%). The mean age was 54.9 ± 12.4 (12-82) years. Besides, there were more men (53.2%) than women (46.8) patients in this study, and most had unilateral NVG (91.8%).

The sex comparison by age group was illustrated in Figure 1. There are 27 men and 13 women were in the 51-60 age group, 18 men and 16 women were in the 61-70 age group, and furthermore, 12 women and 9 men were in the 41-50 age group.

The range IOP in the initial evaluation was 23-81, 7 mmHg, with a mean IOP of 42.8 mmHg ± 11.2 mmHg (Table 1). In addition, most patients had diabetes (63.1%) and hypertension (54.1%). CRVO (9.9%), cholesterol (6,3%), and branch retinal vein occlusion (BRVO) (0.9%) were a minor distribution of subjects.

According to Figure 2, the most frequent medical intervention of NVG was trabeculectomy (40.5%), followed by medications (18%), trabeculectomy with prior administration of anti-vascular endothelial growth factor (VEGF) (13.5%), and glaucoma drainage device (GDD) (11.7%). The lowest mean IOP decreasing was in GDD with prior administration of the anti-VEGF group (45 mmHg to 15.1 mmHg), as shown in Figure 3 and 4.

Discussion

The age distribution of most NVG patients was in the 51-60 age group, with as many as 39 patients (35.1%), followed by 61-70 years (29.7%). It is in line with a study[11] in Bandung, Indonesia, that the significant distribution of NVG is between 60-70 years (46.16%). It may be because that age group is related to DM. Greater prevalence

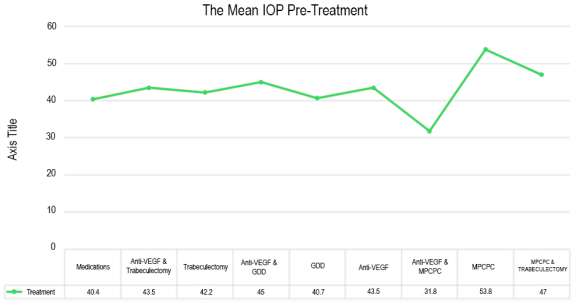

Figure 3. The mean IOP pre-treatment.

Table 1. Patients Characteristics.

Characteristics	N	Frequency Percentage (%)
Age		
< 20	2	1.8
21-40	11	9.9
41-50	21	18.9
51-60	39	35.1
61-70	33	29.7
> 70	5	4.5
Total	**111**	**100**
Sex		
Male	59	53.2
Female	52	46.8
Total	**111**	**100**
Laterality		
Unilateral	102	91.8
Bilateral	9	8.1
Total	**111**	**100**
IOP Initial Visit		
Range (mmHg)	-	23-81.7
Mean (mmHg)	-	42.86
Causes of NVG		
DM	70	63.1
HT	60	54.1
CRVO	11	9.9
Cholesterol	7	6.3
BRVO	1	0.9
Treatment		
Medications	20	18.0
Anti-VEGF & Trabeculectomy	15	13.5
Trabeculectomy	45	40.5
Anti-VEGF & GDD	5	4.5
GDD	13	11.7
Anti-VEGF	7	6.3
Anti-VEGF & MPCPC	1	0.9
MPCPC	3	2.7
MPCPC & Trabeculectomy	2	1.8
Total	**111**	**100**

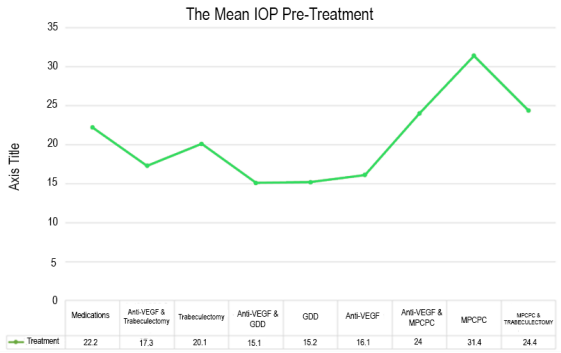

Figure 4. The mean IOP post-treatment.

of DM increases significantly in the > 45-year-old age group.[6],[12] Furthermore, DM has a significant role in the development of NVG.[7] Another study[7] stated that about 65% of PDR patients will develop iris neovascularization, and 20% of them will present NVG. Besides, the risk of developing NVG in the fellow eye was about 33%.[7]

Based on a study by Rodrigues et al.[13], NVG is similar between genders but slightly higher in men. It is related to our study's results that the distribution of men (53.2%) was higher than women (46.8%). The incidence of NVG is more frequent in men than women.[11]

The top three common causes of NVG in this study were DM (63.1%), hypertension (54.1%), and CRVO (9.9%). Poor control of DM and hypertension can lead to NVG.[14] Systemic hypertension can lead to the development of NVG.[15] The most common cause of NVG is diabetic retinopathy, CRVO, BRVO, and BRAO.[16],[17] In contrast, ocular tumors, uveitis, trauma, and eye surgery were the uncommon causes of it.[16]

In our study, trabeculectomy was the most frequent medical intervention (40.5%). It aligns with a study conducted by Yang H et al.[14], which stated that trabeculectomy with mitomycin c or 5-fluorouracil is the conventional surgery for NVG with a low success rate (approximately 33%). It fails due to fibrous tissue obstruction, external scarring, and conjunctival fibrosis (developing neovascular membrane proliferation).[14] However, another study[18] in Japan declared that trabeculectomy with mitomycin c is a relatively better treatment than other ocular surgeries in NVG patients.

In various studies, anti-VEGF has become a hot topic in resolving neovascularization, especially ocular diseases.[13],[14],[19],[20] Visible neovascularization can regress quickly, but it will reappear if the underlying disease cannot be treated.[14] Studies in China, Brazil, Egypt, and Japan mentioned that 95% of patients with anti-VEGF achieved IOP ≤ 21mmHg than 50% of patients without anti-VEGF.[19] Based on Figures 3 and 4, prior administration of anti-VEGF in trabeculectomy (17.3%) and GDD (15,1%) show a remarkable decrease of IOP than pre-treatment. On the other hand, micropulse transscleral cyclophotocoagulation cannot reduce IOP as well as other

medical interventions. Laser trabeculoplasty is not useful in the treatment of NVG.[14] Recent evidence also stated that GDD has become useful as the primary surgery in refractory glaucoma, such as NVG.[6],[20],[21]

Conclusions

It can be concluded that NVG is more common in men. Most patients presenting NVG had DM and hypertension with a mean IOP of 42.8 mmHg. Trabeculectomy is the most commonly performed procedure in this study.

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