Section: Ophthalmology

Original Research Article

TO EVALUATE ETIOLOGY AND CLINICAL PRESENTATION IN PATIENTS WITH NEOVASCULAR GLAUCOMA IN A TERTIARY

Chinmayee Pradhan[1], Sudhansu Sekhar Pradhan[2], Srabani Pradhan[3], Samabesh Swain[4]

[1]*Consultant, ASG Eye Hospital, Bhubaneswar, Odisha, India.*
[2]*Assistant Professor, Department of General Medicine, MKCG Medical College and Hospital, Berhampur, Odisha, India.*
[3]*Assistant Professor, Department of Community Medicine, Dharanidhar Medical College and Hospital, Keonjhar, Odisha, India.*
[4]*Consultant, Shrusti Eye Care Centre, Bhubaneswar, Odisha, India.*

Received *: 13/07/2024*
Received in revised form *: 07/09/2024*
Accepted *: 23/09/2024*

Corresponding Author:
Dr. Samabesh Swain,
Consultant, Shrusti Eye Care Centre, Bhubaneswar, Odisha, India.
Email: dr.sswain@gmail.com

DOI: 10.70034/ijmedph.2024.3.155

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2024; 14 (3); 865-869

ABSTRACT

Background: To study etiology and clinical presentation in patients with neovascular glaucoma in a tertiary institute over a period of two years.
Material and Methods: Retrospective observational study amongst patients with neovacular glaucoma to document the etiology and clinical presentation of neovascular glaucoma. Detailed history taking, gross systemic examinations, thorough ocular examinations were done and recorded.
Results: A total number of 56 patients with neovascular glaucoma were examined and 33 patients (58.92%) were diabetic and 34 patients (60.71%) were hypertensives. Etiological factors associated with NVG were PDR in 25 cases (44.64%), CRVO in 21 patients (37.50%), chronic RD in 2 patients (3.57%), uveitis in 2 patients (3.57%), in 3 patients (5.35%) cause could not be found and other causes were HRVO, BRVO & aphakia. Most of the patients have BCVA of hand movement only. Examination of opposite eye in 25 patients where PDR being the cause of NVG, NVI was present in 11 and PDR was present in 18 (72%). Characteristic clinical presentations were recorded.
Conclusion: Our data establishes that medical conditions such as systemic hypertension, diabetes and ocular conditions like retinal vein and artery occlusions, aphakia and uveitis were associated with NVG. Early identification and treatment of these conditions will prevent neovascular glaucoma. Neovascular glaucoma is a blinding, intractable disease, difficult to manage and very often resulting in permanent visual loss.
Key Words: Neovascular, occlusions, intractable, permanent.

INTRODUCTION

Neovascular glaucoma (NVG) is a blinding, intractable disease, difficult to manage and often resulting in disastrous visual loss. For a logical understanding and scientific rationale for management of any disease, one first has to know the basic issues involved and the scientifically valid information available on the disease. Neovascular glaucoma (NVG) is classified as a secondary glaucoma which can complicate several ocular diseases characterized by retinal hypoxia.

Neovascular glaucoma (NVG) typically progresses through three distinct stages: iris and/or angle neovascularization (pre-glaucoma), secondary open-angle glaucoma and closed-angle glaucoma. NVG occurs when new vessels proliferate onto the iris surface and over the trabecular meshwork. Hypoxia and poor retinal capillary circulation are believed to be the primary initiating events that lead to neovascularization and glaucoma. The evolution of NVG usually follows an ordered sequence beginning with new vessel formation and ending with fibrovascular membranes migrating over the drainage angle, potentially leading to end-stage glaucoma. There is a high likelihood of profound vision loss once intraocular pressure (IOP) increases, making early diagnosis key to preserving ocular function. Medications, laser treatment, and incisional surgery have been the mainstay of treatment. However, new treatment modalities are emerging that target the neovascular drive and could

potentially lead to better outcomes. Its main feature is the proliferation of a fibrovascular membrane-composed of fragile, abnormal new vessels and myofibroblasts which may cover the anterior chamber angle obstructing aqueous outflow.[1]

Visual loss in NVG is common and may be attributed to a combination of causes, including severe ocular ischemia with progression of the underlying retinal disease, glaucomatous optic nerve damage, cataract formation, corneal decompensation, and phthisis bulbi. The most common cause of surgical failure in patients who have NVG is related to progression of the underlying retinal disease, not to uncontrolled IOP. There are many studies which made a general agreement that approximately one-third of the cases of NVG are attributable to diabetic retinopathy, one-third to central retinal venous obstruction (CRVO), and one-third to diverse causes, with carotid artery occlusive disease being prominent.

To prevent or reduce the visual loss caused by NVG, the first essential is to be aware of the various ocular diseases in which it can develop. Once it develops, early diagnosis and rational management are important to minimize the visual loss. Therefore, the present study aims to report on the etiological factors and clinical presentation of the patients having neovascular glaucoma presenting to our institute.

MATERIAL AND METHODS

This was a retrospective observational study amongst patients presenting with neovascular glaucoma in a tertiary care hospital. A detailed history was taken and hospital records of the patients were used retrospectively to obtain information regarding systemic disorders. After recording best corrected visual acuity in snellen's chart in patients with NVG, detailed slit lamp anterior segment examination was done. Intraocular pressure measurement was done in goldmann applanation tonometry (GAT) in all patients. Four mirror Gonioscopy was done in all patients to know anterior chamber angle status and neovascularisation. Detailed direct and indirect ophthalmoscopy were done in all patients to evaluate retina pathologies associated. Other examinations were done like B-Scan, Fundus Fluorescein Angiography, Optical coherence tomography, Perimetry depending on ocular media clarity. Gross systemic examinations and laboratory investigations wherever necessary.

Criteria of Eligibility

Inclusion Criteria: Patients of age 20 to 95 years, both the genders are eligible, patients giving consent for examination, patients presenting with neovascular glaucoma due to various causes.

Exclusion Criteria: Patients with unstable vitals requiring primary systemic stabilization, Patients suffering from HIV and Hepatitis B, Patients with other types of glaucoma (POAG, PACG, congenital glaucoma, secondary glaucoma other than NVG, etc.), Patients who are debilitated.

Patients satisfying the above criteria were included in the study.

RESULTS

Our study is a retrospective hospital based observational study where a total number of 56 patients (30 males and 26 females) were included and recorded in excel sheet. All the cases were thoroughly interrogated, examined and investigated.

26 patients (46.43%) with NVG were above 60 years of age group and 24 patients (42.86 %) with NVG were in between 40 to 60 years of age group. As per the study, both right eye and left eye (53.57 % vs 46.43 % respectively) were equally involved in NVG.

As per the study among 56 patients with NVG, 33 patients (58.92%) were diabetic of which 21 patients (63%) were taking insulin injection along with oral medications and 34 patients (60.71%) were hypertensives. [Table 1]

As per the study, it was found that etiological factors associated with NVG were PDR in 25 patients (44.64%), CRVO in 21 patients (37.50%), chronic RD in 2 patients (3.57%), uveitis in 2 patients (3.57%), in 3 patients (5.35%) cause could not be found and other causes associated are HCRVO(1.79%), BRVO (1.79%) & aphakia (1.79%). [Table 2]

As per the present study, 12 patients (21.43%) were asymptomatic, 36 patients(64.23%) were presented with pain, 31 patients (55.36%) were presented with headache, 44 patients(78.57%) were presented with redness and blurred vision, 23 patients(41.07%) were presented with nausea & vomiting, and 27 patients(48.21%) with photophobia. On examination of these patients, 56 patients(100%) were having NVI, 50 patients(89.29%) were having raised IOP, 44 patients(78.57%) were having conjunctival congestion(CC),ciliary congestion(CCC) & sluggishly or nonreacting pupil, 21 patients(37.50%) with corneal edema, 15 patients (26.79%) with ectropion uvea, 13 patients(23.21%) with NVA & optic disc cupping , 9 patients(16.07%) with hyphaema & PAS and 3 patients(5.36%) with AC reaction. [Table 4]

In our study, 17 patients (30.36%) had BCVA of hand movement only and 9 patients (16.07%) had only light perception in their involved eyes but 14 patients (25%) had no light perception in their involved eyes. Most of the patients had BCVA of hand movement only in the involved eyes in this study. IOP in 25 patients (44.64%) was between 20-40 mmHg, in 16 patients (28.57%) was between 40-60 mm Hg and in 9 patients (16.07%) it was above 60 mm Hg. In 6 patients (10.71%) with NVG, IOP was within normal limits but having NVI. As per our study, clinical presentation of NVG

was found in 16 patients (76.19%) out of 21 patients having history of CRVO since 3 - 6 months. [Table 5]

Table 1: Associated Systemic Diseases

SYSTEMIC DISEASES	NO. OF CASES	PERCENTAGE
DIABETES MELLITUS	33	58.92 %
HYPERTENSION	34	60.71 %

Table 2: Associated Etiological Factors

ETIOLOGICAL FACTORS	NO. OF CASES	PERCENTAGE
PDR	25	44.64 %
CRVO	21	37.50 %
HCRVO	01	1.79 %
BRVO	01	1.79 %
CHRONIC RD	02	3.57 %
UVEITIS	02	3.57 %
APHAKIA	01	1.79 %
UNKNOWN	03	5.35 %
TOTAL	56	100 %

Table 3: Symptoms

SYMPTOMS	NO. OF CASES	PERCENTAGE
ASYMPTOMATIC	12	21.43%
PAIN	36	64.23%
HEADACHE	31	55.36%
REDNESS	44	78.57%
NAUSEA AND VOMITING	23	41.07%
BLURRED VISION	44	78.57%
PHOTOPHOBIA	27	48.21%

Table 4: Signs

SIGNS	NO. OF CASES	PERCENTAGE
CC & CCC	44	78.57%
RAISED IOP	50	89.29%
CORNEAL EDEMA	21	37.50%
HYPHAEMA	09	16.07%
ECTROPION UVEA	15	26.79%
SLUGGISHLY OR NON REACTING PUPIL	44	78.57%
AC REACTION	03	5.36%
NVA	13	23.21%
NVI	56 (67 eyes)	100%
OPTIC DISC CUPPING	13	5.36%
PAS	09	16.07%

Table 5: BCVA in Involved Eyes

BCVA	NO. OF CASES	PERCENTAGE
NO LIGHT PERCEPTION	14	25 %
LIGHT PERCEPTION ONLY	09	16.07 %
HAND MOVEMENT ONLY	17	30.36 %
LESS THAN 3/60	04	7.14 %
3/60 OR BETTER	12	21.43 %
TOTAL	56	100 %

DISCUSSION

Systemic diseases and NVG

Studies done by Glacet-Bernard A et al2a and Hansen LL et al,[2] b showed that Arterial hypertension (32–70%), atherosclerotic heart disease (22–50%), hyperlipidemia (30–60%) and diabetes mellitus (14–34%) are most commonly found to be associated with CRVO which subsequently leads to neovascular glaucoma when untreated. In our study, 33 patients (58.92%) were diabetic and 34 patients (60.71%) were hypertensives out of 56 patients. Our study reported similar results.

Intraocular diseases and NVG

In one review of patients with NVG admitted in the 1960s to a Danish hospital, 43% had glaucoma attributed to diabetic retinopathy, 37% had glaucoma attributed to CRVO, and the rest had glaucoma from miscellaneous causes (Madsen PH et al,[3] 1971). Despite the widespread use of PRP, the picture has not changed greatly. In 1984, of 208 consecutive cases of NVG diagnosed over 4 years, 36% were caused by CRVO, 32% by diabetic retinopathy, and 13% by CAOD (Brown et al,[4]

1984).At present, probably one-third of the cases of NVG are attributable to CRVO, one-third to diabetic retinopathy, and one-third to diverse causes, with CAOD being prominent. Similar results were found in the study. In an epidemiological study by Kaufman SC et al,[5] 1987 on a Danish island, the prevalence of NVG was 2% of all diabetics and 21% of all diabetics with PDR. Numerous studies have reported widely varying incidences of this complication, ranging from 15% to 65%, with an average of ~30%.[6] The natural history of untreated CRVO is that essentially none of the nonischaemic eyes progress on to NVG whereas 187 to 60%8 of eyes in the ischaemic group do so .(Magargal LE et al,[7] 1981 and Laatikainen L et al,[8] 1977). Hayreh et al,[9] 1983 proved in a study that NVG is only a complication of the ischaemic hemi-CRVO and not in non-ischaemic type. In one series, NVG developed in 3% (one of 31) ischaemic HCRVO eyes. There is little risk of NVG following typical or isolated branch retinal vein occlusion. A study by Grant WM,[10] 1974 showed that CAOD is the third most common cause of NVG, accounting for at least 13% of cases.Study by Perry et al,[11] 1975; Coppeto et al,[12] 1985 showed that NVG can occur in anterior, posterior or panuveitis and can be due to the inflammation itself or anterior segment ischaemia. Uveitis in the presence of chronic iridocyclitis, Fuch's uveitis syndrome, scleritis and carotid occlusive disease (OIS) has been especially implicated in NVG. As per Diabetic Retinopathy Vitrectomy Study13 in the diabetic group, 83% of the eyes with retinal detachment developed NVI–NVG versus 2% of the eyes with an attached retina. For comparison, it should be noted that 2% of eyes with severe PDR progressed on to NVG even without vitrectomy. Aphakia alone did not correlate significantly with the development of NVI and NVG. However, aphakia combined with retinal detachment was associated with an even greater risk of NVI and NVG (92%) developing in the diabetic group.

As per our study, most common etiological factor associated with NVG was proliferative diabetic retinopathy. CRVO was the second most common etiological factor causing NVG in our study. Other etiological factors were chronic RD, uveitis, HCRVO, BRVO & aphakia. Similar results were found in above studies.

Clinical presentation of NVG

Redness of eye and blurred vision were the chief complaints in majority of the patients in our study. Other presenting clinical symptoms were pain, headache, nausea & vomiting and photophobia.[12] patients (21.43%) were found to be asymptomatic in our study. Similar results were seen in multiple studies done by Shazly TA,[14] Yazdani S et al,[15] and Rhee DJ et al16 which stated that although NVG can present without symptoms, patients typically report some combination of redness, pain, photophobia, headache and decreased vision, though all may not be present in each case. If the IOP has climbed to more severe levels, the patient may also complain of nausea, vomiting and intense headaches. Important clinical signs of NVG are rubeosis irides/NVI, NVA, PAS, elevated IOP, conjunctival injection, anterior chamber reaction, corneal edema secondary to increased IOP, hyphema, ectropion uvea (eversion of pupillary margin), optic nerve cupping and visual field loss. Shazly TA et al,[14] in their study stated that everted pupillary margin stems from the traction of the fibrovascular membrane between the iris itself and the iridocorneal angle structures during membrane contraction. Their study revealed that hyphaema in NVG that Spontaneous hyphema from a rupture in the fragile iris or angle neovascular blood vessels is possible in all stages mentioned earlier, but is more common in stages 2 and 3. Our study found characteristic clinical picture in NVG patients.

Visual acuity status and IOP in NVG patients

In our study BCVA in most of the patients with NVG was hand movement or worse in their involved eyes. On examination, majority of our NVG patients were having raised IOP. Similar results were seen in studies done by Olmos LC et al,[20] and Shazly TA.[14] NVG typically progresses through three distinct stages: iris and/or angle neovascularization (pre-glaucoma), secondary open-angle glaucoma and closed-angle glaucoma. Similar study done by Kuang TM et al,[17] showed that entering visual acuity in NVG patients is dependent on when treatment was initiated. Reported acuities typically range from 20/40 to no light perception, with most cases being 20/200 or worse. Study done by Wand M et al,[18,19] proved that visual acuity is often at the counting fingers to hand- motion level, and the IOP may be 60 mm Hg or higher in patients with NVG. Hence in our Study, we found that patients those who have raised IOP and NVG, end up having irreversible worsening of vision.

NVI status of other eye in NVG where PDR is a cause

In the study, examination of opposite eye in 25 patients where PDR being the cause of NVG, NVI was present in 11 patients (44%) and PDR was present in 18 patients (72%). IOP measured in opposite eye was within normal limits. Gartner S et al,[21] in his study proved that bilateral NVI or NVG in an adult is almost always caused by diabetic retinopathy. Madsen PH et al,[22] in his study stated that the time interval between the onset of NVI and NVG in untreated cases varies from 1 month to more than 3 years. Our study is in agreement with most of the above studies. Therefore, our study emphasized on examination of other eye for NVG especially patients with proliferative diabetic retinopathy.

CRVO and time of presentation of NVG

As per our study, clinical presentation of NVG was found in most patients with history of CRVO since 3 - 6 months as documented in hospital records. Similar results are also seen in studies done by Magargal LE et al.[23] An overall incidence of NVG

of 40% for the ischaemic type of CRVO is supported by the largest, least-biased study.[25] NVG can appear at any time from 2 weeks to 2 years after the initial occlusion, but in more than 80% of the cases, NVI and NVG appear within the first 6 months after CRVO.[25] As per a study by Hayreh et al,[24] the risk of developing NVG in eyes with ischaemic CRVO reaches a maximum of about 45% in aggregate over several years where the maximum risk being during the first 7–8 months only. Retinal neovascularization typically forms in the first 6-12 months following a BRVO; however, it may develop years later also.

Limitation of Our Study

Single hospital study may not represent the general population. To establish the causative factors for NVG large sample size with a long duration that is more than 5 years follow up is recommended for study.

CONCLUSION

NVG is a severely blinding disease. To prevent or reduce the extent of visual loss caused by NVG, the first essential thing is to have a high index of suspicion of its development; if NVG develops, early diagnosis and aggressive control of high IOP is crucial to minimize the visual loss. The most common diseases responsible for development of NVG are ischemic CRVO, diabetic retinopathy and ocular ischemic syndrome. In the management strategy, the first priority should be to try to prevent its development by appropriate management of the causative diseases.

REFERENCES

1. Neovascular glaucoma, Martin Wand. Principles and Practice of Ophthalmology: Daniel M. Albert, MD, MS,et al. Second Edition. W.B. Saunders Company.
2. (A) Glacet-Bernard A, Coscas G, Chabanel A, Zourdani A, Lelong F, SamamaMM(1996). Ophthalmology 103:551–60 (B) Hansen LL, Wiek J, Schade M, Muller-Stolzenburg N, WiederholtM (1989a). Ophthalmologica199:90–99
3. Madsen PH: Haemorrhagic glaucoma: Comparative study in diabetic and non-diabetic patients. Br J Ophthalmol 1971; 55:444.
4. Brown GC, Magargal LE, Schachat A, etal: Neovascular glaucoma: Ophthalmology consideration. Ophthalmology 1984: 91:315
5. Kaufman SC, Ferris FL III, Swartz M: Diabetic Retinopathy Study Research Group: Arch Ophthalmol 1987; 105:807.
6. Grant WM: Management of neovascular glaucoma. In: Leopold IH , ed. Symposium on ocular therapy, St. Louis: CV Mosby; 1974:36-61.
7. Magargal LE, Brown GC, Augsburger JJ, et al: Neovascular glaucoma following central retinal vein obstruction. Ophthalmology 1981; 88:1095.
8. Laatikainen L, Kohner EM, Khoury D, etal: Panretinal photocoagulation in central retinal vein occlusion: A randomized controlled clinical study. Br J Ophthalmol 1977; 61:741.
9. Hayreh SS. Classification of central retinal vein occlusion. Ophthalmology 1983; 90:458-474.
10. Grant WM: Management of neovascular glaucoma. In: Leopold IH, ed. Symposium on ocular therapy, St. Louis: CV Mosby; 1974:36-61.
11. Perry, HD; Yanoff, M; Scheie,HG (1975). Rubeosis in Fuch's heterochromic iridocyclitis. Arch Ophthalmol. 93: 337-9.
12. Coppeto, JR; Wand, M; Bear, L; Sciarra, R (1985). Neovascular glaucoma and carotid artery obstructive disease. Am J Ophthalmol. 99: 567-70.
13. Diabetic Retinopathy Vitrectomy Study Group: Two-year course of visual acuity in severe proliferative diabetic retinopathy with conventional management. Ophthalmology 1985; 92:492.
14. ShazlyTA, Latina MA. Neovascular glaucoma: etiology, diagnosis and prognosis. Semin Ophthalmol. 2009 Mar-Apr;24(2):113-21.
15. Yazdani S, Hendi K,. Intravitreal bevacizumab (Avastin) injection for neovascular glaucoma. J Glaucoma. 2007 Aug;16(5):437-9.
16. Rhee DJ (ed.). Glaucoma: Color Atlas & Synopsis of Clinical Ophthalmology. 1st ed. New York: McGraw Hill; 2003:326-8.
17. Kuang TM, Ling Liu CJ, Chou CK, Hsu WM. Clinical experience in the management of neovascular glaucoma. J Chin Med Assoc. 2004 Mar;67(3):131-5.
18. Eid TM, Radwan A, el-Manawy W, el-Hawary I. Can J Ophthalmol. 2009 Aug;44(4):451-6.
19. Al-Aswad L. Rev Ophthalmol. Available at: www.revophth.com/content/d/glaucoma_management/i/1313/c/25277/. Accessed March 27, 2014.
20. Olmos LC, Lee RK. Medical and surgical treatment of neovascular glaucoma. Int Ophthalmol Clin. 2011 Summer; 51(3):27-36.
21. Gartner S, Taffet S, Friedman AH: The association of rubeosis iridis with endothelialisation of the anterior chamber: Br J Ophthalmol 1977; 61: 267.
22. Madsen PH: Rubeosis of the iris and haemorrhagic glaucoma in patients with proliferative diabetic retinopathy. Br J Ophthalmol 1971; 55:369.
23. Magargal LE, Donoso LA, Sanborn GE: Retinal ischemia and risk of neovascularization following central retinal vein obstruction. Ophthalmology 1982; 89:1241.
24. Hayreh SS, Rojas P, Podhajsky P, et al: Ocular neovascularisation with retinal vascular occlusion. III: Ophthalmology 1983; 90:488.
25. Hayreh SS. Classification of central retinal vein occlusion. Ophthalmology 1983; 90:458-474.