**GNZ 2024 CME Cases and MCQs**

Case: Neovascular glaucoma secondary to CRVO

**Learning outcomes**

- To understand the definition and pathophysiology of non-arteritic anterior ischaemic optic neuropathy (NAION)
- To recognise the clinical presentation of CRVO
- To identify the risk factors associated with CRVO
- To understand the management options for CRVO

**History**

A 55 year old male reports spots in his vision in his left eye over the last two days. These spots do not move around. He has had treatment in the past for glaucoma

Previous ocular history: Right central haemorrhage with previous laser ~12 years ago
Previous medical history: High cholesterol
Current medications: Lumigan at night, both eyes
Family history: Nil

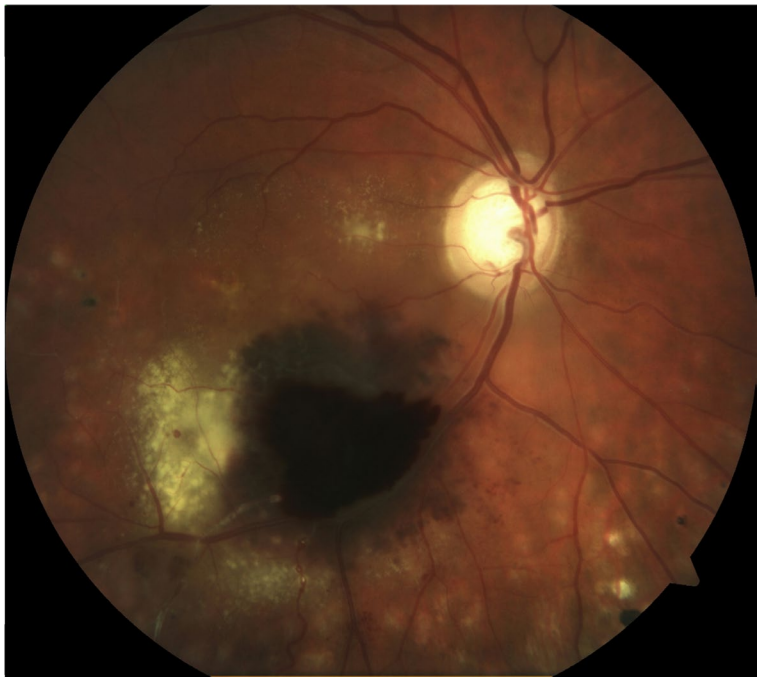
**Examination**

Examination findings on presentation shown below.

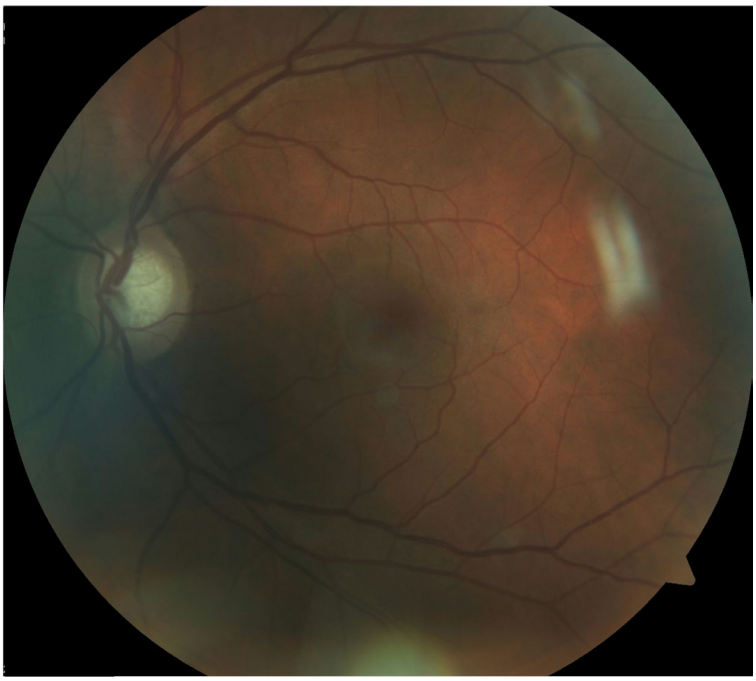
| | **Right eye** | **Left eye** |
|---|---|---|
| **Best corrected visual acuity** | 6/60 | 6/4.8 |
| **Subjective refraction** | -0.25 DS | -1.00 DS |
| **Goldmann tonometry** | 16 mmHg | 17 mmHg |
| **Pachymetry** | 499 µm | 499 µm |
| **Gonioscopy** | Open angles<br>No evidence of neovascularisation | Open angles<br>No evidence of neovascularisation |
| **Ishihara** | 12/14 (Slow) | 14 / 14 |
| **Pupils** | R RAPD | |
| **Anterior segment** | Early lens opacification, otherwise unremarkable | Early lens opacification, otherwise unremarkable |
| **Fundus examination** | See image<br>PRP over the inferior retina outside of the arcades | See image |
| **Visual fields** | See visual fields (Figure 1) | |
| **OCT** | See RNFL analysis (Figure 2) and GCC scan (Figure 3) | |

**Figure 1: Colour photographs**

**Right eye**



**Left eye**



**Question 1:**

Describe the colour fundus photographs in Figure 1.

**Answer**:
Both eyes show glaucomatous appearing optic discs.

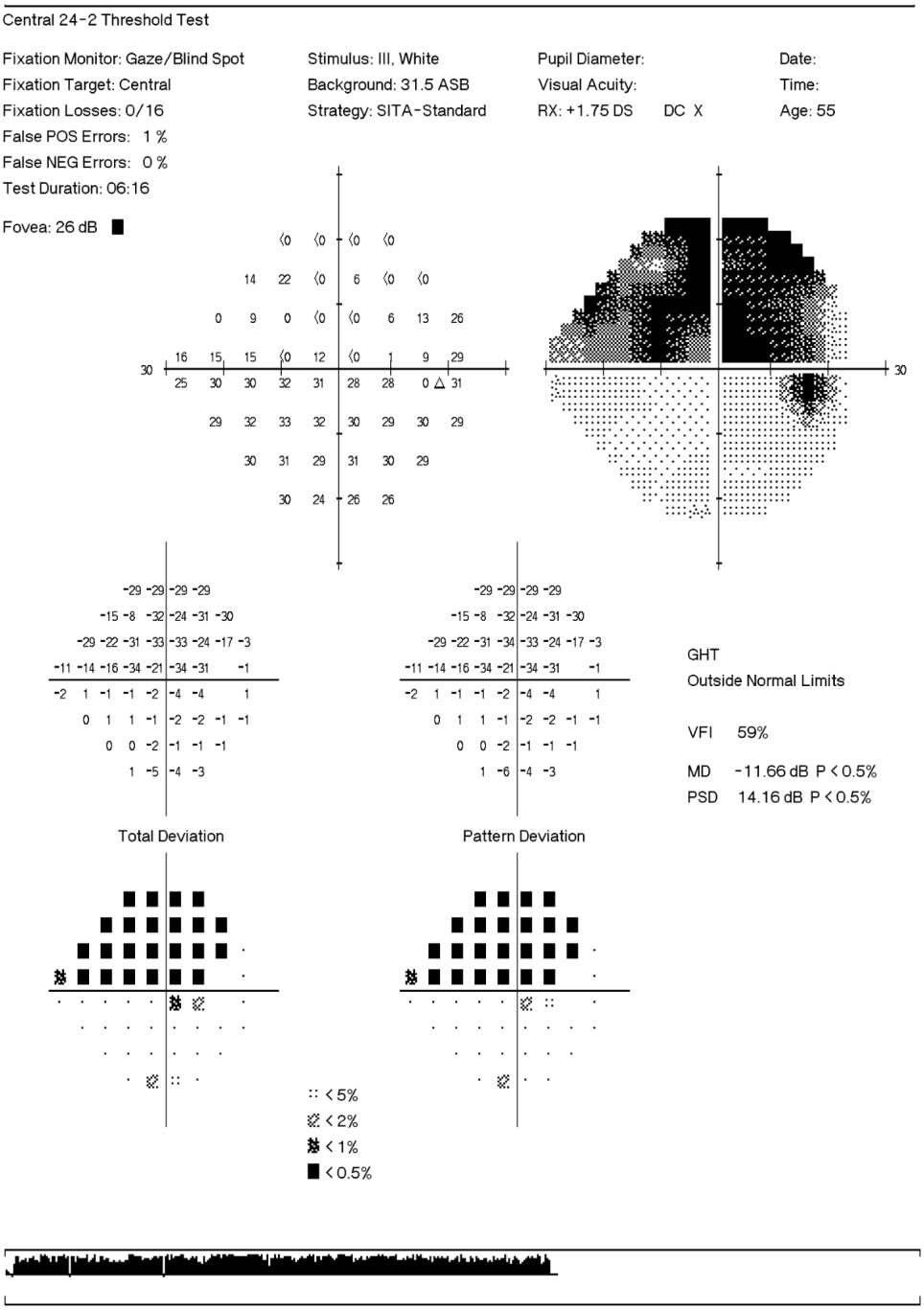
In the right eye there is collection of subretinal and sub-RPE blood over the temporal arcade, as well as hard exudate. The right eye has a large optic cup measuring 0.85 with increased pallor and superior thinning.

The left eye optic is cupped with a cup to disc ratio is 0.6. The macula and flat and the peripheral retina is unremarkable.

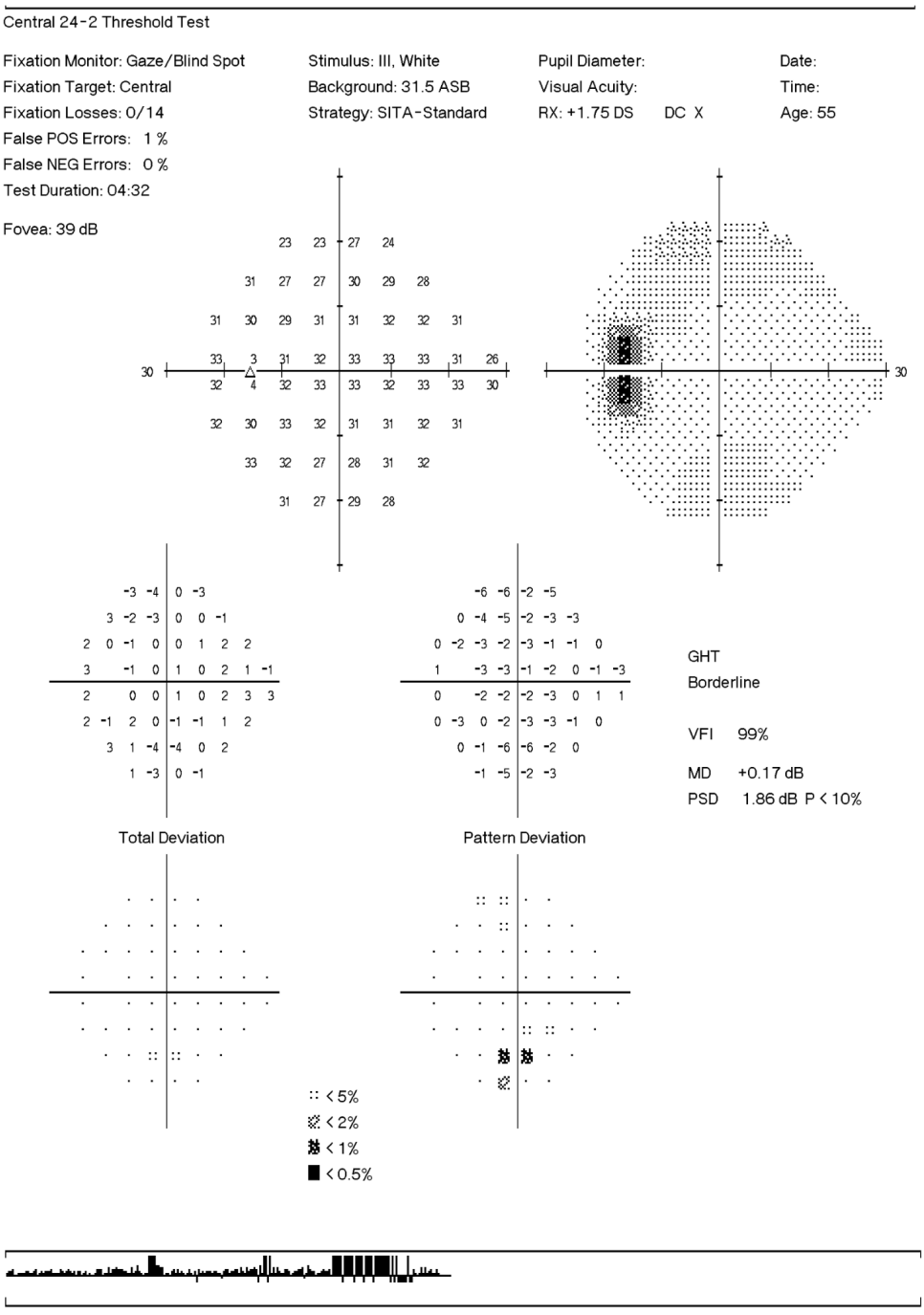
**Answer ends**

## Figure 2: Visual fields

### Right eye



## Left eye


Central 24-2 Threshold Test
Fixation Monitor: Gaze/Blind Spot
Fixation Target: Central
Fixation Losses: 0/14
False POS Errors: 1 %
False NEG Errors: 0 %
Test Duration: 04:32
Fovea: 39 dB
Stimulus: III, White
Background: 31.5 ASB
Strategy: SITA-Standard
Pupil Diameter:
Visual Acuity:
RX: +1.75 DS DC X
Date:
Time:
Age: 55
GHT
Borderline
VFI 99%
MD +0.17 dB
PSD 1.86 dB P < 10%
Total Deviation
Pattern Deviation
:: < 5%
< 2%
< 1%
< 0.5%

**Question 2:**

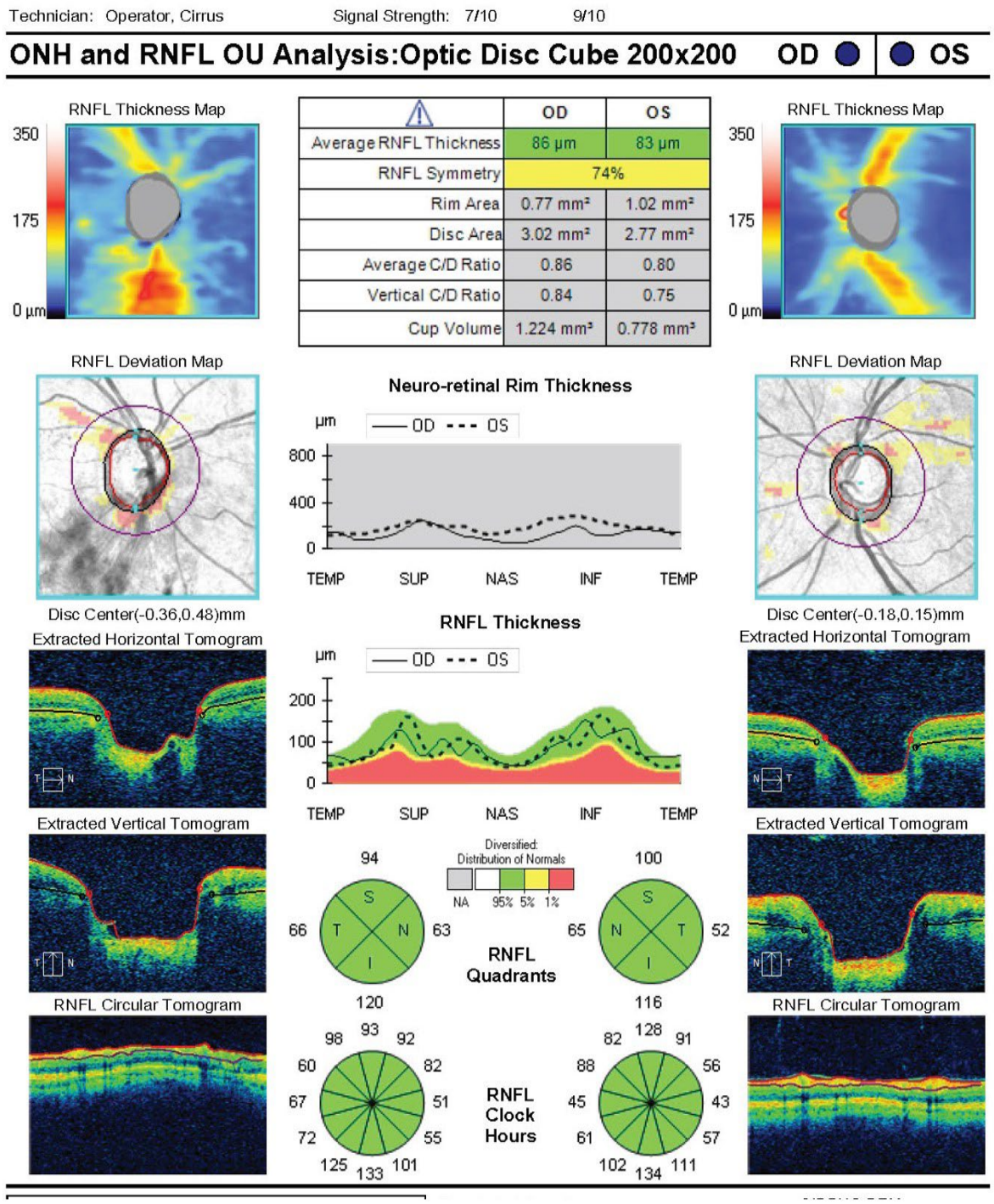
**What is your assessment of the visual fields?**

**Answer**

This is a HVF 24-2 visual field for the right and left eye. There is a superior hemi-field defect in the right eye. There is excessive gaze movement. The left eye visual field is unremarkable aside from some increased eye movement towards the end of the test.

**Answer ends**

## Figure 3: RNFL thickness analysis



**Question 3**

**Describe the patient's OCT retinal nerve fibre layer (RNFL) and ganglion cell layer (GCL) analysis**

**Answer**
The RNFL OCT scans are of good quality and adequate signal strength (7/10 in the right eye, 9/10 in the left eye). There is mild asymmetry between the two eyes. The RNFL thickness is within normal limits for both eyes.

**Answer ends**

An MRI of the brain is ordered. It shows minor asymmetry in diameter of the optic nerves but no altered signal and no abnormal enhancement. There was no orbital or retro-orbital mass lesion detected.

**Question 4**

**What is your working diagnosis?**

**Answer**
This patient presents with a complex ocular picture.

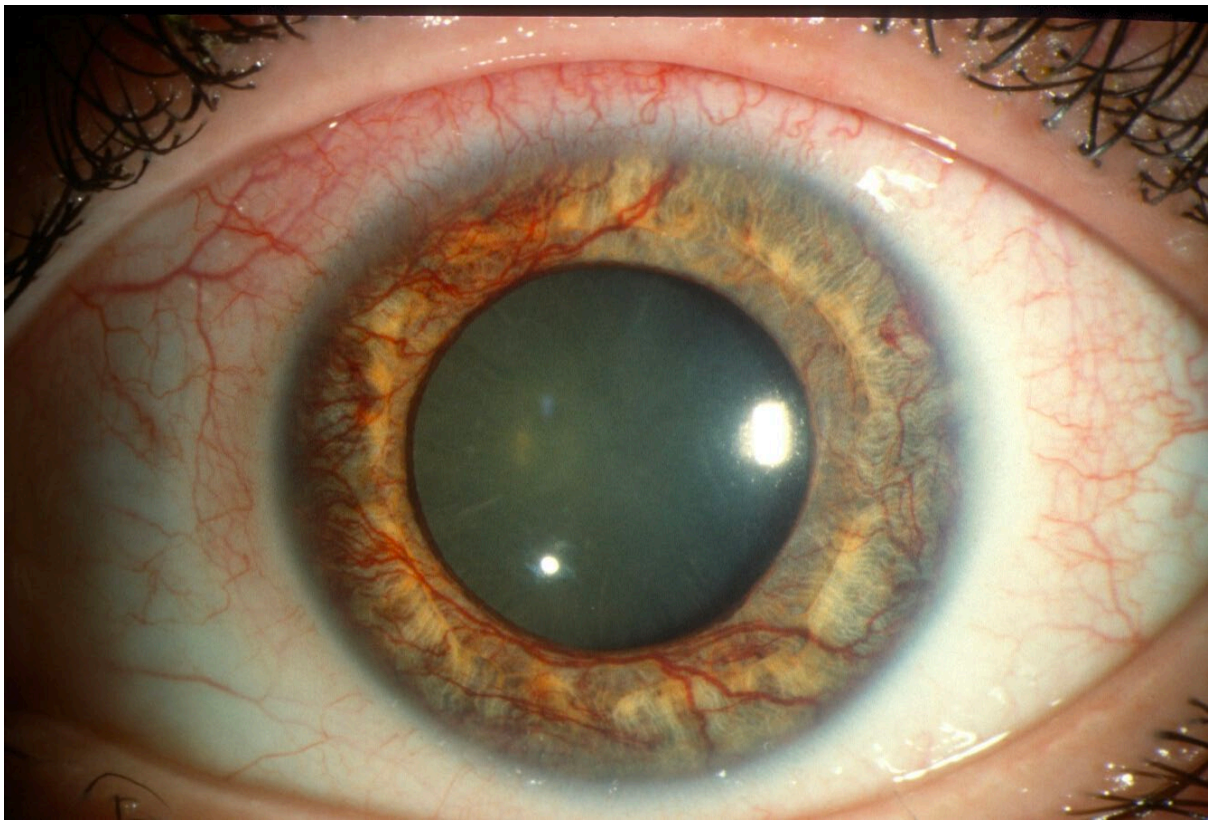
First, his right eye has a presumed hemi-retinal vein occlusion, previously treated with PRP laser. He now presents with new subretinal and sub-retinal pigment epithelium (RPE) haemorrhages.

Second, his optic discs show evidence suggesting glaucomatous optic neuropathy. The right eye has open angle glaucoma with an old CRVO. The left eye shows no features of glaucoma but given that he is using topical Lumigan, he may have had ocular hypertension , which was presumably well controlled because of the drops.

This case highlights the importance of a thorough history and examination in managing patients with potentially overlapping pathologies. A 2019 meta-analysis assessed the relationship between glaucoma and retinal vein occlusion (RVO) risk with 15 studies meeting the inclusion criteria. The relationship between glaucoma and RVO is somewhat controversial. While analyses, including the Blue Mountains Eye Study, *(Cugati et al. 2006)* suggest glaucoma as a key risk factor for RVO, others like the Beaver Dam Eye Study *(Klein et al. 2000)* and Singapore Malay Eye Study *(Lim et al. 2008)* studies find no significant association after controlling for age.

The patient returns to you 5 years later. His right eye is shown in Figure 4.

**Figure 4**



Reproduced from https://morancore.utah.edu/section-10-glaucoma/neovascularization-of-the-iris-rubeosis-iridis/

**Question 5:**

Describe the Figure 1

**Answer**:
This is a colour photograph focused on a patient's right eye with extensive new blood vessels across the iris and extending nasally. These visible vessels are highly suggestive of rubeosis iridis, or neovascularistaion of the iris (NVI). This term describes the abnormal proliferation of blood vessels on the iris surface. If left untreated, rubeosis iridis can progress to neovascular glaucoma.

Early detection is crucial for managing rubeosis iridis. The condition typically begins at the edge of the pupil (pupillary border) with the appearance of tiny, clustered, dilated capillaries. These might present as small red spots, often only visible under high magnification.

**Answer ends**

**Question 6:**

Why do patients with NVG and a high IOP (e.g. IOP > 40 mmHg) not complain of pain?

**Answer:**
Neovascularisation is a chronic process and it is likely that the obstruction of aqueous outflow that occurs in neovascular glaucoma can build up slowly over a long period of time. This slow increase in IOP may not cause discomfort or corneal oedema such as in acute angle closure. In some cases however, angle closure may occur rapidly and the symptoms as well as clinical findings may mimic acute angle closure.

**Question 7:**

What are the three most common causes of neovascular glaucoma?

**Answer:**
Neovascular glaucoma (NVG) is a secondary glaucoma in which new vessels, and subsequently fibrous tissue, form in the anterior chamber angle of the eye. This leads to blockage of the angle, which inhibits aqueous drainage, causing elevated intraocular pressure (IOP).

The most common causes of neovascular glaucoma are:
1. Diabetic retinopathy
This is most commonly related to proliferative diabetic retinopathy (PDR), approximately 50% of patients with PDR have rubeosis iridis (Shazly et al 2009)

2. Ischemic central retinal vein occlusion
The definition of an ischemic versus and non-ischemic CRVO can be made based on a combination of factors such as VA, visual fields and electrodiagnostic testing, fluorescein angiography and fundus findings. (Hayreh 2007)
The incidence of neovascular glaucoma after CRVO is approximately 16%. If VA is less than 6/60 within 1 month of a CRVO the chance of NVG is over 30%, in those with VA better than 6/12 it is only 5% (Shazly et al 2009)
Classically neovascular glaucoma is known as the '100 day glaucoma' is it usually occurs 3 months after the CRVO. 80% of cases occur within 6 months (Shazly et al 2009)

3. Ocular ischemic syndrome (OIS)
This is due to insufficient blood supply to the eye, most commonly due to occlusive disease at the carotid artery however this can also be due to occlusion at the aortic arch, ophthalmic artery and ciliary artery.
Patients with OIS can present with a normal or even low IOP despite angle neovascularisation, due to ischemia of the ciliary body and decreased aqueous production

**Answer ends**

**Question 8:**

What should be done to manage the high IOP in patients with NVG?

**Answer:**
Medical treatment

- Topical beta-blockers, carbonic anhydrase inhibitors, prostaglandin analogue and alpha agonists should be administered if there are no contraindications or allergies
- If necessary oral or IV therapy with diuretics or osmotic agents may be necessary in patients who do not have an adequate response to topical treatment or are in significant discomfort

Surgical treatment

- Trabeculectomy and other filtering surgeries may be required if medical therapy is unsuccessful in controlling IOP
- Glaucoma drainage implant (GDI) surgery has been used with some success as their outcome is less dependent on inflammation. (Olmos and Lee 2011)
- Cyclodestructive procedures such as cyclodiode laser treatments are generally reserved for eyes with poor visual potential

**Answer ends**

**Question 9:**

What other treatment is indicated?

Answer:
The second aim of treatment is to control the ischemic drive for neovascularization using:

1. Panretinal photocoagulation (PRP) is indicated in diabetic retinopathy but its effectiveness in ischemic CRVO and OIS are debatable. (Hayreh 2007) Treatment with laser may not be possible if there is vitreous haemorrhage or significant cataract.
2. Anti-VEGF agents such as Avastin have shown good effect in recent studies for all aetiologies of NVG. (SooHoo et al 2013)
3. Corticosteroid therapy, either topical or intravitreal therapy has shown incidental benefit for reducing iris neovascularization and decreasing IOP. However in steroid responsive patients this can also increase IOP. (Hayreh 2007)
4. Treatment of the underlying disease such as:
    a. Improving management of diabetes and blood glucose control
    b. Management of microvascular risk factors (blood pressure, cholesterol, blood sugar) to minimise the chance of further vascular events in CRVO and OIS
    c. Carotid ultrasound and cerebrovascular imaging looking for potential occlusions is indicated in OIS

**Required reading and references**

**Required reading**

Senthil S, Dada T, Das T, Kaushik S, Puthuran GV, Philip R, Rani PK, Rao H, Singla S, Vijaya L. Neovascular glaucoma - A review. Indian J Ophthalmol. 2021 Mar;69(3):525-534. doi: 10.4103/ijo.IJO_1591_20. PMID: 33595466; PMCID: PMC7942095.

**Recommended reading**

Rittiphairoj T, Roberti G, Michelessi M. Anti-vascular endothelial growth factor for neovascular glaucoma. Cochrane Database of Systematic Reviews 2023, Issue 4. Art. No.: CD007920. DOI: 10.1002/14651858.CD007920.pub4.

Olmos, L., Sayed, M., Moraczewski, A. et al. Long-term outcomes of neovascular glaucoma treated with and without intravitreal bevacizumab. Eye 30, 463–472 (2016). https://doi.org/10.1038/eye.2015.259

Yin X, Li J, Zhang B, Lu P. Association of glaucoma with risk of retinal vein occlusion: A meta-analysis. Acta Ophthalmol. 2019 Nov;97(7):652-659. doi: 10.1111/aos.14141. Epub 2019 May 24. PMID: 31125174.

Shazly TA, Latina MA. Neovascular Glaucoma: Etiology, Diagnosis and Prognosis. Semin Ophthalmol 2009;24(2):113-21 doi: 10.1080/08820530902800801[published Online First: Epub Date]|.