ORIGINAL STUDY

Management of Neovascular Glaucoma With Panretinal Photocoagulation, Intravitreal Bevacizumab, and Subsequent Trabeculectomy With Mitomycin C

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Introduction

Neovascular Glaucoma

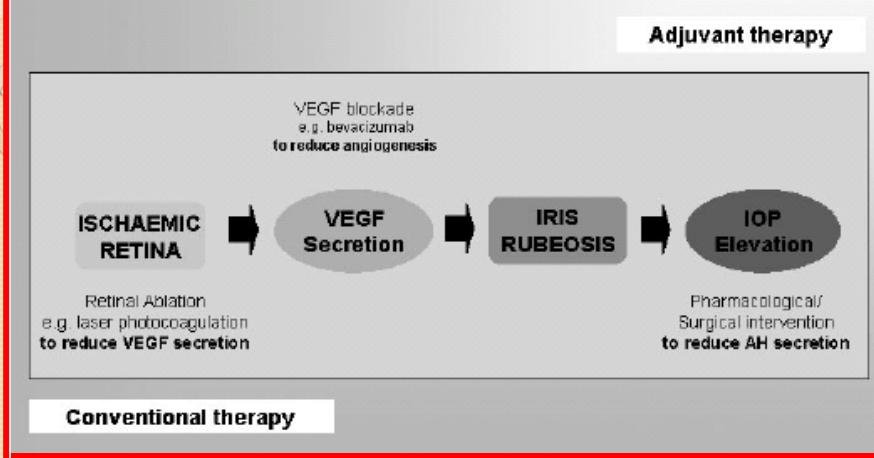
- **NVG is a devastating disease.**
- **Its management is complex and frequently requires the integrated use of medical, laser, and surgical modalities.**

Pathogenesis of NVG

- Linked to locally produced angiogenic growth factor: vascular endothelial growth factor (VEGF) (Tripathi et al, 1998).
  - In NVG and anterior segment neovascularization, the level of VEGF in the aqueous humor is significantly increased (Tripathi et al, 1998).
  - Artificially elevating VEGF levels in animal eyes was sufficient to result in NVI and NVG (Tolentino et al, 1996).

Bevacizumab (Avastin)

- Bevacizumab is a VEGF-A inhibitor,
- Causes regression of NVI when injected into the vitreous or anterior chamber (Mason et al, 2006).
- Regression occurs quickly, often within 1 week; (Bakri et al, 2007).
- Regression of anterior segment neovascularization may persist for 4 to 10 weeks (Iliev ME, 2006).



Mechanisms of the different therapeutic strategies in neovascular glaucoma.
VEGF = vascular endothelial growth factor; IOP = intraocular pressure; AH = aqueous humour

Aim of the study

- **To evaluate the safety and efficacy of intravitreal bevacizumab (IVB; Avastin) injection, PRP, and trabeculectomy with intraoperative MMC in the management of eyes with NVG.**

PATIENTS AND METHODS

- **17 eyes with NVG were included in the study.**
- **PRP was performed in either single or multiple sessions depending on the view to the retina and patient tolerance.**
- **Intravitreal injection of 1.25mg (0.05 mL) bevacizumab (Avastin; 100 mg/4 mL) was given in the operating room through the pars plana.**
- **Trabeculectomy with MMC (**0.4 mg/mL for 3 minutes) **was performed within 1 month after IVB injection**

Main outcome measures

- **The following data were were compared before and after trabeculectomy :**
  - **Visual acuity,**
  - **IOP,**
  - **number of antiglaucoma medications,**
  - **NVI.**
- **The intraoperative and postoperative complications were also recorded.**

The surgical outcome was defined as follows:

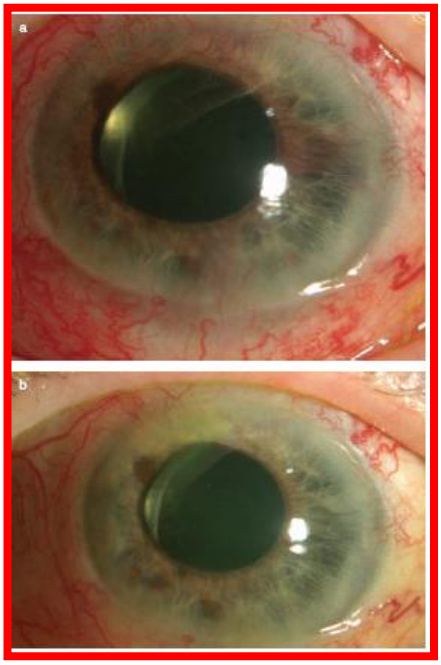
- 1. Complete success as IOP ≤21mm Hg without antiglaucoma medications;
- 2. Qualified success as IOP ≤ 21mm Hg with antiglaucoma medications;
- 3. Complete failure for eyes that required further antiglaucoma surgery, developed phthisis bulbi or lost light perception.

RESULTS

- The causes of NVG included:
  - diabetic retinopathy (10eyes),
  - central retinal vein occlusion (5 eyes),
  - and branch retinal vein occlusion (2 eyes).

RESULTS

- Complete regression of iris neovascularization (INV) after IVB and PRP occurred in 82.4%.
- In 17.6%, INV was reduced but did not disappear completely.
- The mean time to regression was 17.8 days (±4.8 SD; range: 8 to 27ld).
- NVI recurrence was observed in 29.4%.



Mean IOP before and after IVB and PRP

- **Mean IOP before IVB and PRP was 47.2±7.7mm Hg that decreased to 42.9±4.2mm Hg within 1 month after IVB injection.**

Initial and final visual acuities

	No. (%)
Initial visual acuity	
1/60 or worse	7 (41.2)
> 1/60 to 6/60	6 (35.3)
Better than 6/60	4 (23.5)
Final visual acuity	
No light perception	2 (11.8)
1/60 or worse	6 (35.3)
> 1/60 to 6/60	4 (23.5)
Better than 6/60	5 (29.4)

SUCCESS CRITERIA

Success criteria	No. (%)
1. Complete success	9 (52.9)
2. Qualified success	6 (35.3)
3. Complete failure	2 (11.8)

Changes in mean intraocular pressure (IOP) along the follow-up period.

TABLE 2. Mean Preoperative and Postoperative IOP in the Study Group Along the Follow-up Period

Duration	IOP (Mean ± SD)*	P†
Before surgery	42.9 ± 4.2	< 0.05
First week	15.1 ± 2.2	< 0.05
First month	16.3 ± 2.0	< 0.05
Third month	18.6 ± 2.1	< 0.05
Sixth month	19.7 ± 2.1	

*Two eyes needed cyclocryotherapy to control the IOP.
†The matched pairs *t* test was used.
IOP indicates intraocular pressure.

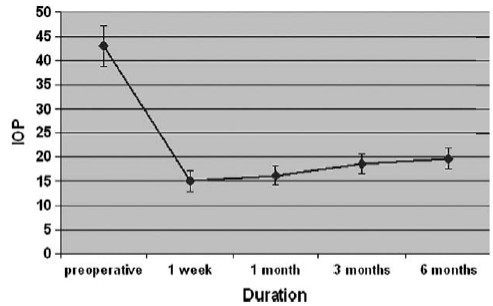


FIGURE 1. Changes in mean intraocular pressure (IOP) along the follow-up period.

Intraoperative complications

- **hyphema in 1 eye.**
  - **It was mild and the blood was rapidly absorbed within the first postoperative week**

Postoperative complications

TABLE 3. Postoperative Complications in the Study Group

Complications	Patients	
	Number	%
1. Hypotony	3	17.6
2. Conjunctival dehiscence	1	5.9
4. Shallow anterior chamber	2	11.8
5. Corneal erosion	1	5.9
5. Hyphema	4	23.5
6. Choroidal detachment	2	11.8
7. Blebitis	—	—
8. Endophthalmitis	—	—

Of the 5 eyes with recurrent neovascularization,

- Additional PRP and IVB injection was performed that resulted in regression of the neovascularization in 3 eyes.
- In 2 eyes persistent neovascularization was present and the trabeculectomy was not functioning.
- These 2 eyes needed cyclocryotherapy to control the IOP and these were the eyes that lost light perception.

DISCUSSION

- The key to NVG management lies in elimination of the angiogenic stimulus before surgery by adequate PRP or anterior retinal cryotherapy.
- The success of all types of filtration surgery depends ultimately on prevention of filtration bleb fibrosis, infection, and wound leaks (Mandal et al, 2008).

- Bevacizumab causes regression of NVI when injected into the vitreous or anterior chamber. (Mason et al, 2006).
- The effect of bevacizumab on neovascular regression shows that VEGF plays an important role in the pathogenesis of NVG.
- If intravitreal injection of bevacizumab is combined with PRP, this will theoretically cause regression of neovascularization early until the long-lasting effect of PRP occurs.(Ehlers et al, 2008)

- Adjuvant bevacizumab for NVG may offer a more effective treatment of the neovascular trigger, might be able to prevent further PAS formation and secondary angle damage, and thereby may prevent the need for surgical intervention (Eliev et at, 2006 and Ehlers et al, 2008)

Even if its effect is transient, bevacizumab may have at least an adjunctive role to PRP

- Because of its rapid, dramatic biologic effect.(bevasizumab: rapid, PRP= permanent)
- It could be of benefit in the presence of media opacity precluding PRP.
- It may also act as a surgical adjuvant as preoperative administration of bevacizumab is shown to reduce intraoperative bleeding for trabeculectomy or vitreoretinal surgery (Batiolu et al, 2006).

Conclusion

- The options available for NVG management have limited success
- Trabeculectomy with intraoperative MMC after an adjunctive treatment with IVB and PRP is a good treatment modality in the management of eyes with NVG.
- It is effective in reducing NVI and intraoperative complications during trabeculectomy.


THANK YOU