Early vitrectomy combined with pan retinal photocoagulation, anti-vascular endothelial growth factor, and gradual cyclophotocoagulation for treatment of neovascular glaucoma

Chuan Sun, Hong-Song Zhang, Yu-Jie Yan, Tong Zhao, Ai-Hong Li, Yan Tang, Zhi-Jun Wang

Department of Ophthalmology, China-Japan Friendship Hospital, Beijing 100029, China.

To the editor: Neovascular glaucoma (NVG) is refractory glaucoma characterized by neovascularization of iris or anterior chamber angle, which often leads to dramatic elevation of intraocular pressure (IOP) and severe vision loss.[1-3] Series of studies have been reported regarding managing NVG with anti-vascular endothelial growth factor (VEGF) therapy or in combination with anti-glaucoma surgery.[2-4] However, the effect of anti-VEGF seems only temporary and it does not improve the prognosis in the long term.[3] Therefore, pan retinal photocoagulation (PRP) remains necessary for improving long term prognosis.[3] However, it is not easy to complete PRP early in NVG patients due to corneal edema, hyphema, or vitreous hemorrhage. We conducted this prospective interventional case series study to propose a protocol which could confine NVG in an early stage. The aims of our treatment modalities included that controlling IOP immediately, complete PRP as soon as possible, anti-VEGF as adjuvant and controlling residual glaucoma with gradual cyclophotocoagulation.

The study was approved by the Institutional Review Board of China-Japan Friendship Hospital and was conducted in accordance with the Declaration of Helsinki. Forty-six patients (52 eyes) were enrolled from January 2013 to December 2017. The period of follow-up was at least 6 months. The inclusion criteria included: 1) IOP ≥ 21 mmHg. 2) Neovascularization on iris or anterior chamber angle was observed. 3) The causes of NVG were retinal ischemic diseases. The exclusion criteria included: 1) Patient was complicated by severe systemic disease and could not tolerate surgery. 2) Patient had received anti-glaucoma surgeries. All patients received a detailed clinical history interview and ophthalmic examination, including slit lamp examination, gonioscopy, fundus photography, and iris/fundus fluorescein angiography.

The treatment schedule was shown in Figure 1 and explained in brief as follow. IOP was lowered as soon as possible. Paracentesis was performed in patients with IOP higher than 40 mmHg. To complete PRP as soon as possible, a 25-gauge vitrectomy was performed in patients with severe corneal edema, hyphema, cataract or vitreous hemorrhage, and complete PRP was performed during surgery using the wide angle viewing system. Intravitreal injection of bevacizumab (Avastin, Roche, Switzerland) was performed in following situations: 1) In the end of vitrectomy, when PRP could not be completed due to dense retinal hemorrage. 2) Neovascularization on iris or anterior chamber angle recurred during follow-up after complete PRP. Transscleral cyclophotocoagulation (TCP) was performed if IOP remained higher than 30 mmHg which could not be controlled by medication. To prevent hypotony, TCP was performed in a gradual manner. The 90 degrees of ciliary body were always reserved, usually the upper temporal quadrant. The intervals for repeated TCPs should be at least 1 month. The Student’s t test was used to compare IOP before and after treatment, while comparison of visual acuity was calculated using Chi-square test. Data were presented as mean ± standard deviation. Logistic regression was performed to determine the prognostic factors for final visual acuity (BCVA < 0.05 or ≥ 0.05).

IOP on last follow-up (15.41 ± 3.74 mmHg, range 10–25 mmHg) was significantly lower than before treatment (39.67 ± 10.47 mmHg, range 23–64 mmHg) (t = 15.73, P < 0.05). The IOPs of all the patients were reduced. In 48 eyes (92%) the IOPs were lower than 21 mmHg. 45 eyes (87%) did not need medication to control eye pressure. The visual acuity improved in 32 eyes (62%). In all the 32 eyes, the BCVA were 0.02 or better, and in 19 (37%) eyes, the BCVA were even 0.1 or better. The BCVA remained unchanged in 17 eyes (33%), and were decreased in three eyes (6%). All the three eyes had NVG secondary to PDR.
silicone oil tamponade was performed in one of them due to retinal detachment. Logistic regression showed that the eyes those had better visual acuity on diagnoses, received more anti-VEGF injections, or did not need to receive cyclophotocoagulation may have better prognosis of final visual acuity. The main complications of TCP included postoperative pain, transient IOP elevation and hyphema. Transient IOP elevation usually occurs on the 1 to 3 days post-surgery. Eight patients developed hyphema which resolved in 1 week. Three patients developed hypotony around 1 to 2 weeks after TCP, and the IOP gradually recovered during follow-up.

The results of our comprehensive treatment protocol were favorable in terms of IOP control. Moreover, the visual acuity improved in the majority of patients. However, we should always keep in mind that the management of NVG is challenging, NVG can recur due to recurrence of retinal ischemia, and close follow-up is always required in these patients.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published, and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.
Conflicts of interest
None.

References
1. Hayreh SS. Neovascular glaucoma. Prog Retin Eye Res 2007;26:470–485. doi: 10.1016/j.preteyeres.2007.06.001.
2. Sun Y, Liang Y, Zhou P, Wu H, Hou X, Ren Z, et al. Anti-VEGF treatment is the key strategy for neovascular glaucoma management in the short term. BMC Ophthalmol 2016;16:150. doi: 10.1186/s12886-016-0327-9.
3. Iliev ME, Domig D, Wolf-Schnurrbursch U, Wolf S, Sarra GM. Intravitreal bevacizumab (Avastin) in the treatment of neovascular glaucoma. Am J Ophthalmol 2006;142:1054–1056. doi: 10.1016/j.ajo.2006.06.066.
4. Li XJ, Yang XP, Li QM, Wang YY, Lyu XL. Ranibizumab plus combined surgery for treatment of neovascular glaucoma with vitreous hemorrhage. Chin Med J 2015;128:2078–2083. doi: 10.4103/0366-6999.161371.
5. Olmos LC, Sayed MS, Moraczewski AL, Gedde SJ, Rosenfeld PJ, Shi W, et al. Long-term outcomes of neovascular glaucoma treated with and without intravitreal bevacizumab. Eye (Lond) 2016;30:463–472. doi: 10.1038/eye.2015.259.

How to cite this article: Sun C, Zhang HS, Yan YJ, Zhao T, Li AH, Tang Y, Wang ZJ. Early vitrectomy combined with pan retinal photocoagulation, anti-vascular endothelial growth factor and gradual cyclophotocoagulation for treatment of neovascular glaucoma. Chin Med J 2019;132:2518–2520. doi: 10.1097/CM9.000000000000482