Treatment of retinal capillary hemangioma using 810 nm infrared laser

Pavel Pochop, Martina Kodetova, Dagmar Dotrelova

Aim. Presentation of the efficacy of infrared laser for the treatment of retinal capillary hemangioma (RCH).
Methods. The treatment and follow-up of nine eyes (fourteen tumors of different sizes and localizations) in seven patients (five children) with RCH. Infrared diode laser (810 nm) was used for modified transpupillary thermotherapy (TTT) in long exposition mode and power between 200 and 1200 mW with a beam diameter of 2 mm (indirect ophthalmoscope, +28 D or +40 D lens) or 0.5 mm-3 mm (slit-lamp) depending on the diameter and localisation of the hemangioma.
Results. We achieved complete destruction of the tumor with flat chorioretinal atrophic scar in all cases. Only one tumor regrowth was observed and re-treatment in this case was necessary. Treatment was combined with brachytherapy in a one case. There was one serious complication- total exudative retinal detachment, causing permanent deterioration in visual acuity despite pars plana vitrectomy (PPV). Other complications such as haze and vitreal hemorrhage were transient. The final best corrected visual acuity (BCVA) ranged from 20/20 to counting fingers at 2 feet.
Conclusion. Infrared laser can be considered an acceptable therapeutic option for RCH especially for centrally localized lesions. We believe that the role of this therapy will increase in the future.

Key words: retinal capillary hemangioma, infrared diode laser, transpupillary thermotherapy, treatment, von Hipple-Lindau

Received: January 14, 2018; Accepted: April 13, 2018; Available online: May 16, 2018
https://doi.org/10.5507/bp.2018.019

Department of Ophthalmology for Children and Adults, Second Faculty of Medicine, Charles University, Prague and University Hospital Motol, Prague, Czech Republic
Corresponding author: Pavel Pochop, e-mail: pavel.pochop@gmail.com

INTRODUCTION

Retinal capillary hemangiomas (RCH), also called capillary hemangioblastomas, are benign circumscribed vascular lesions, usually with dilated feeding artery and draining vein. They may occur as either hereditary or sporadic cases. Familial RCHs are part of the autosomal dominant von Hippel-Lindau disease (VHL). They may be multifocal and also bilateral[1]. Treatment of this sight-threatening condition can be complicated and used to be unsatisfactory. An indication for treatment depends on tumor size, tumor location and any associated findings. Near infrared diode laser (NIDL) is a very recent treatment option. This was used in the past for the treatment of choroidal hemangiomas[2], and treatment of RCH was mentioned several years later[3]. We describe the efficacy and safety of NIDL in a series of Czech patients.

METHODS

This is a prospective observational case series. Patients were treated between 1998 and 2016 at the Department of Ophthalmology for Children and Adults at the University Hospital Motol in Prague. Fourteen RCHs of different sizes and localization in 9 eyes of 7 patients were enrolled into the study. The patient details are shown in Table 1. We used 810 nm diode infrared laser Oculight SLx (Iris Medical Instruments, Mountain View, CA) in all cases. Diode laser coupled with a slit-lamp (aperture 0.5–3.0 mm) and Goldmann's three-mirror lens were used for treatment of adult patients and laser indirect ophthalmoscope (aperture 2.0 mm and +28 D or +40 D lens) for treatment of children under general anesthesia. The power settings ranged between 200 and 1200 mW based on the diameter of the spot size and duration of the laser pulse (60 s) was kept constant. The goal of treatment was whitening and flattening of the exposed tissue. Mean number of sessions needed was 2.5 (range 1 to 11) usually with 3 weeks' interval between them. Ophthalmological examinations with fundoscopy and color fundus photographs were performed periodically at three month intervals in the first year after treatment and later yearly. The mean follow-up was 10.5 (range 0.5 to 18 years).

RESULTS

All tumors were totally destroyed. Table 2 shows the results of treatment, number of sessions required for each tumor and where indicated additional treatment. The first patient had reduced best corrected visual acuity (BCVA) due to macula involvement (Fig. 1). We focused a laser beam onto a feeding artery in order to reduce blood flow before tumor treatment. The tumor was completely destroyed by laser therapy and the BCVA improved to 20/80. There was evidence of regrowth of the tumor in the scar after 6 years and due to enlargement retreatment

Table 1. Cohort of patients with retinal capillary hemangioma.

Patient	Sex	Age (years)	Laterality	VHL	Number of Tumors	Localisation
1	F	21	L	no	1	P
2	M	10	RL	yes	R 4	J+P
					L 2	J+P
3	M	11	R	no	1	J
4	M	11	L	no	1	J
5	F	53	L	no	1	P
6	M	15	RL	yes	1	P
					1	P
7	M	17	L	yes	2	P

M-male, F – female, R – right eye, L – left eye, P – peripheral, J – juxtapapillary, VHL – von Hippel-Lindau

Table 2. Results of treatment.

Case no.	Localisation	Size	TTT	Visual acuity	Final visual acuity	Another treatment
1	L P Equatorially	2.5 DD	3x	20/200	20/80	Laser coagulation of vessels
2	R J	2.0 DD	4x	20/40p	15/200	–
	R P Pre-equatorially	1.5 DD	1x			
	R J	0.5 DD	1x			
	R P Equatorially	1.5 DD	2x			
	L J	0.5 DD	1x	20/20	20/20	–
	L P	0.5 DD	1x			
3	R J	4x3 DD	4x	10/200	20/200	–
4	L J	4x3 DD	11x	20/120	20/80	Plaque radiotherapy Laser photocoagulation
5	L P 3DD of the optic disc	2x2.5 DD	4x	20/40	20/20	–
6	R P Pre-equatorially	1.0 DD	1x	20/20	20/20	–
	L P Pre-equatorially	1.0 DD	1x	20/20	Hand motion	PPV
7	R P Equatorially	1.0 DD	1x	20/20	20/20	–
	L P	1.5 DD	2x	20/20	20/20	–
	Pre-equatorially L P	1.0 DD	1x			

R – right eye, L – left eye, P – peripheral, J – juxtapapillary, DD – disc diameter, PPV – pars plana vitrectomy

was necessary. The tumor in the right eye of the second patient was partly located on the optic nerve head (Fig 2). We focused the laser beam onto the peripheral part of the tumor. Cicatrisation causes displacement of the tumor away from the surface of the disc. Treatment of the tumor was possible without direct damage to the optic nerve. The BCVA was decreased due to spread of the tumor toward the macular region. We found regrowth of the tumor in the scar four years later and a new equatorially localized tumor was discovered in the right eye of this patient fourteen years later. The nasal peripheral part of a centrally localized tumor of the fourth patient showed activity, growth and leakage of fluorescein despite a number of sessions. For this reason we decided to combine laser treatment with Ru-106 plaque brachytherapy which resulted in the total disappearance of the tumor. Treatment of a peripheral tumor in the right eye of the sixth patient proceeded without incident (unlike the peripheral tumors of the patients above). Treatment of a peripheral tumor in the left eye was complicated by exudative retinal detachment (Fig. 3). For this reason, we performed pars plana vitrectomy (PPV) but subsequent cicatrisation and shortening of the retina caused deterioration of vision to counting fingers. Treatment of the last patient was accompanied by the same complication (Fig. 4). One of the tumors and surrounding retina were detached within hours after laser therapy. We treated the tumor once again with a higher power and a drop in exudation resulted in reattachment of the retina. This result was stable over the following months.

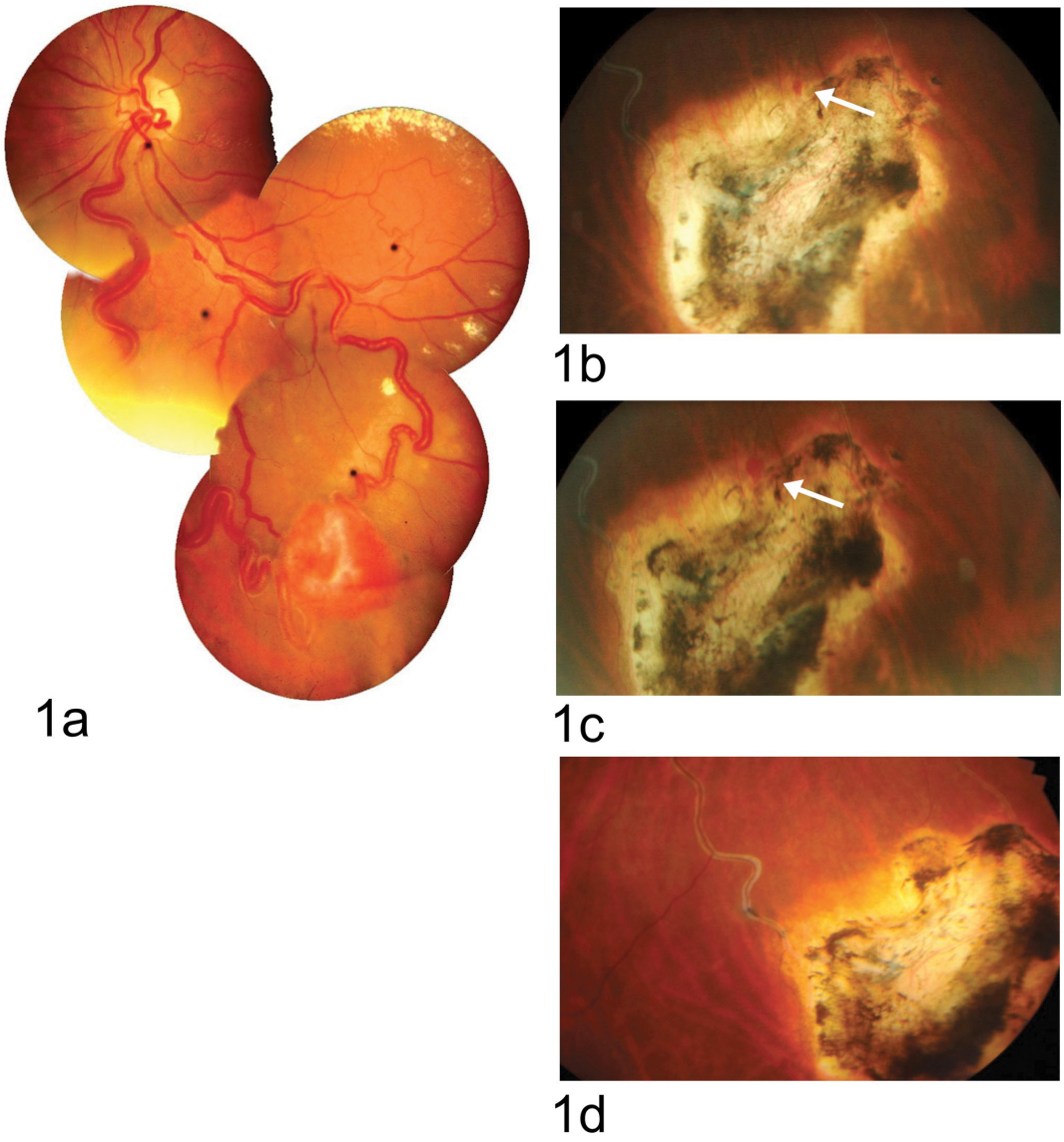

Fig. 1. a) Peripherally localized hemangioma with feeding vessels. b) Regrowth of hemangioma in the periphery of the scar (arrow). c) Enlargement of tumor two years later (arrow). d) Chorioretinal scar after retreatment.

DISCUSSION

Various modalities for the treatment of RCH have been described and though the situation remains difficult, observation is usually the guide to initial management[4,5]. Spontaneous regression has been observed[6], but we believe this is extremely uncommon. We closely follow first, patients with VHL disease and treat new RCHs without delay. Peripheral RCHs are successfully treated with cryotherapy[7], and brachytherapy[8], but serious complications such as irradiation retinopathy and exudative retinal detachment also occur.

The role of transpupillary thermotherapy (TTT) in the treatment of RCHs, according to some authors, is uncertain and its efficacy questionable[5-10]. Some are of the opinion that TTT insufficiently coagulates the capillary vessels of the tumor because of the high blood flow[10]. We agree with this caveat. TTT utilizes a diode laser of wavelength 810 nm to raise the temperature within treated tumor tissue, causing dilation of capillaries and exudative retinal detachment is a predictable effect of such treatment. We believe that full thickness coagulation of the tumor is necessary to avoid such complications and for this reason, we use higher power than is usual in TTT.

Stereotactic radiotherapy[11] and proton beam radiotherapy[5,12] have been rarely used for treatment of RCHs. Radiotherapy provided limited benefit for most patients with some needing additional treatment[5] and complications of radiotherapy may appear many years after the irradiation[13].

Today juxtapapillary RCHs can be treated using a variety of current methods and often with a combination of several treatment methods such as 25-gauge vitrectomy with photodynamic therapy (PDT) (ref.[14]) or PDT with intravitreal administration of vascular endothelial growth factor (VEGF) receptor antibody[15]. These methods usually do not completely destroy the hemangioma but reduce their size and diminish exudation[14-16]. Exact prediction of the future behavior of hemangioma is problematic. Exudative retinal detachment is a rarely reported compli-

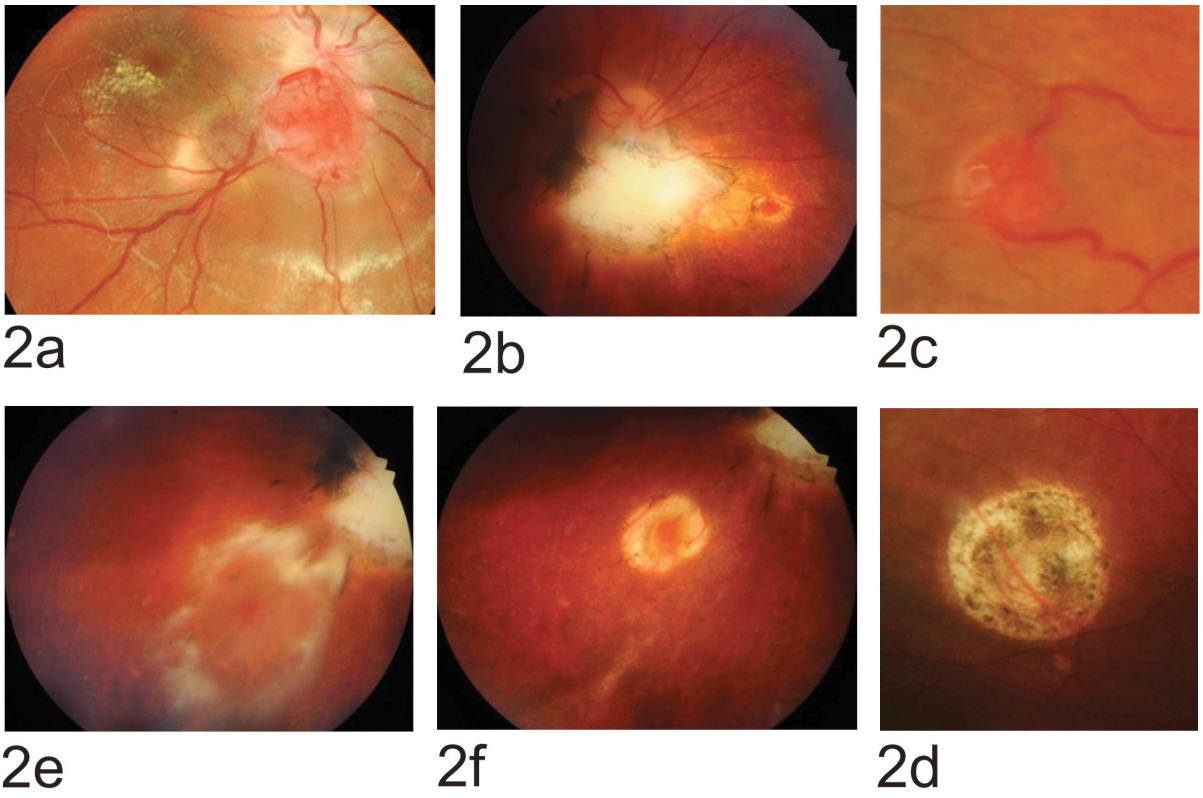

Fig. 2. a) Retinal juxtapapillary hemangioma with lipid exudate in the macula. b) Chorioretinal scar in the original place of the tumor. c) Peripheral tumor of the right eye. d) Scar after treatment. e) New angioma with surrounding exudate in the right eye. f) Same place after treatment.

cation of PDT and anti-VEGF therapy[17]. If we compare these methods to NIDL, we find that PDT and anti-VEGF therapy are less destructive and less aggressive.

CONCLUSION

NIDL has the ability to destroy RCHs in any location, mostly in one session. Additionally, this photocoagulation can be used for the treatment of RCHs in cases of detached retina. From our experience, it is best to coagulate the tumor in full thickness to avoid complications though further treatment/retreatment is sometimes necessary. The main disadvantage of NIDL therapy is scar formation in surrounding retina. Combination of NIDL with PDT and anti-VEGF therapy, especially in cases of centrally localized tumors, appears to be effective. In sum, NIDL is not a universal treatment for any RCH but it is a good method of choice.

Acknowledgment: This work was presented orally at the Global Pediatric Ophthalmology Congress, London, UK, June 06-07, 2016. Supported by the project (Ministry of Health, Czech Republic) for conceptual development of research organization 00064203 (University Hospital Motol, Prague,Czech Republic). Many thanks to Alexander Oulton for proof reading.
Author contributions: PP: study design, manuscript writing; MK: data collection; DD: proofreading, final approval.

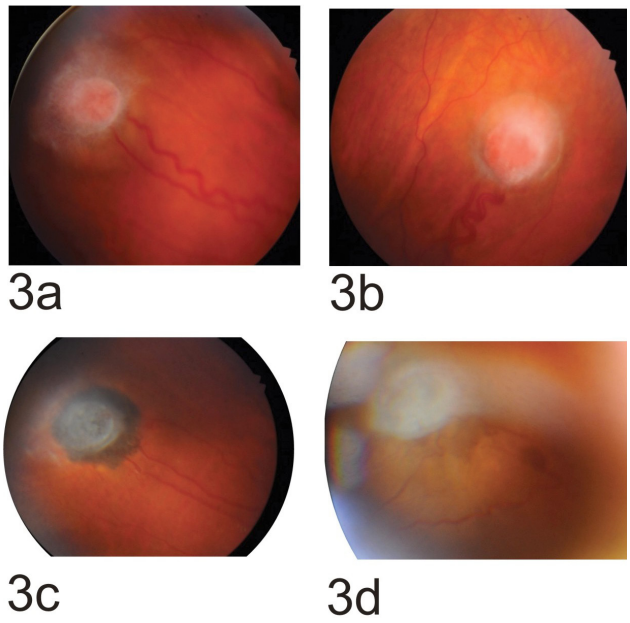

Fig. 3. a) Peripheral retinal hemangioma in the right eye. b) Somewhat larger tumor in the left eye. c) Tumor in the right eye after treatment. d) Left eye - replacement of the tumor by fibrous tissue in detached retina.

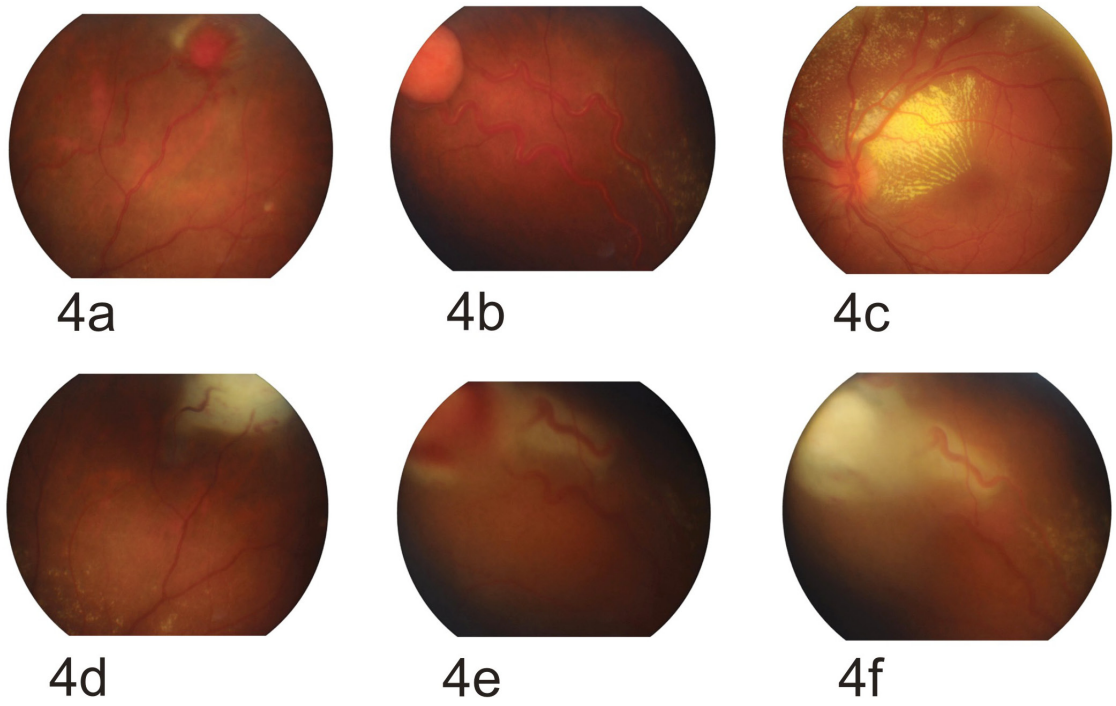

Fig. 4. a) Small hemangioma in the temporal superior quadrant. b) Larger hemangioma of the pre-equatorial retina in the nasal superior quadrant. c) The lipid exudate in the macula. d) Thermally coagulated tissue of the smaller tumor. e) Larger tumor after first treatment in detached retina. f) Successful reattachment of the retina after total coagulation of the hemangioma.

Conflict of interest statement: The authors declare that there is no conflict of interest.

REFERENCES

1. Singh AD, Shields JA, Shields CL. Solitary retinal capillary hemangioma. Hereditary (von Hippel-Lindau disease) or nonhereditary? Archives of Ophthalmology 2001;119:232-4.
2. Lanzetta P, Virgili G, Ferrari E, Menchini U. Diode laser photocoagulation of choroidal hemangioma. Int Ophthalmol 1995;19:239-47.
3. Parmar DN, Mireskandari K, McHugh D. Transpupillary Thermotherapy for retinal Capillary Hemangioma in von Hippel-Lindau Disease. Ophthalmic Surg Lasers 2000;31:334-6.
4. Saitta A, Nicolai M, Giovannini A, Mariotti C. Juxtapapillary Retinal Capillary Hemangioma: New Therapeutic Strategies. Med Hypothesis Discov Innov Ophthalmol 2014;3:71-5.
5. Singh AD, Nouri M, Shields CL, Shields JA, Perez N. Treatment of retinal capillary hemangioma. Ophthalmology 2002;109:1799-806.
6. Milewski SA. Spontaneous regression of a capillary hemangioma of the optic disc. Arch Ophthalmol 2002;120:1100-1.
7. Shields JS. Response of Retinal Capillary Hemangioma to Cryotherapy. Arch Ophthalmol 1993;111:551.
8. Kreusel KM, Bornfeld N, Lommatzsch A, Wessing A, Foerster MH. Ruthenium-106 brachytherapy for peripheral retinal capillary hemangioma. Ophthalmology 1998;105:1386-92.
9. Singh AD, Shields CL, Shields JA. von Hippel-Lindau disease. Surv Ophthalmol 2001;46:117-42.
10. Garcia-Arumi J, Sararols LH, Cavero L, Escalada F, Corsostegui BF. Therapeutic Options for Capillary Papillary Hemangiomas. Ophthalmology 2000;107:48-54.
11. Pilbauer J, Hejdukova I, Pasta J, Pochop P, Vladyka V, Liscak D, Simonova G. Personal experience with treatment of vascular diseases using the Leksell gamma knife. Cesk Slov Oftalmol 1998;54:235-40. (in Czech)
12. Seibel I, Cordini D, Hager A, Riechardt AI, Klein JP, Heufelder J, Moser L, Joussen AM. Long-term results after proton beam therapy for retinal papillary capillary hemangioma. Am J Ophthalmol 2014;158:381-6.
13. Archer DB, Amoaku WMK, Kelly G. Choroidoretinal neovascularisation following radon seed treatment of retinoblastoma in two patients. Br J Ophthalmol 1993;77:95-9.
14. Mariotti C, Giovannini A, Reibaldi M, Nicolai M, Saitta A. 25-gauge vitrectomy combined with half-fluence photodynamic therapy for the treatment of juxtapapillary retinal capillary hemangioma: a case report. Case Rep Ophthalmol 2014;5:162-7.
15. Matuskova V, Vyslouzilová D. The Use of anti-VEGF preparations and PDT in the treatment of retinal juxtapapillary hemangioma - a case report. Cesk Slov Oftalmol 2014;70:196-200.
16. Agarwal A, Kumari N, Singh R. Intravitreal bevacizumab and feeder vessel laser treatment for a posteriorly located retinal capillary hemangioma. Int Ophthalmol 2016;36:747-50. doi: 10.1007/s10792-016-0183-x
17. Hyeong MK, Kyu HP, Se JW. Massive Exudative Retinal Detachment Following Photodynamic Therapy and Intravitreal Bevacizumab Injection in Retinal Capillary Hemangioma. Korean J Ophthalmol 2015;29:143-5.