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 thermodotherapy (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 thermodotherapy, treatment, von Hippel-Lindau
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.
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. Spontaneous regression has been observed, 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, and brachytherapy, 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. Some are of the opinion that TTT insufficiently coagulates the capillary vessels of the tumor because of the high blood flow. 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 and proton beam radiotherapy have been rarely used for treatment of RCHs. Radiotherapy provided limited benefit for most patients with some needing additional treatment and complications of radiotherapy may appear many years after the irradiation.

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) or PDT with intravitreal administration of vascular endothelial growth factor (VEGF) receptor antibody. These methods usually do not completely destroy the hemangioma but reduce their size and diminish exudation. 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. 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.

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

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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.