Published in final edited form as:

Br J Ophthalmol. 2008 August ; 92(8): 1081–1085. doi:10.1136/bjo.2008.138891.

Comparison of the Optical Coherence Tomographic Features of Choroidal Neovascular Membranes in Pathologic Myopia versus Age-Related Macular Degeneration, using Quantitative Subanalysis

Pearse A. Keane,

Doheny Image Reading Center, Doheny Eye Institute, Keck School of Medicine of the University of Southern California, Los Angeles, California, U.S.A

Sandra Liakopoulos,

Department for Vitreoretinal Surgery, Center of Ophthalmology, University of Cologne, Germany

Karen T. Chang,

Doheny Image Reading Center, Doheny Eye Institute, Keck School of Medicine of the University of Southern California, Los Angeles, California, U.S.A

Florian M. Heussen,

Department for Vitreoretinal Surgery, Center of Ophthalmology, University of Cologne, Germany

Sharel C. Ongchin, and

Doheny Eye Institute, Keck School of Medicine of the University of Southern California, Los Angeles, California, U.S.A

Alexander C. Walsh

Doheny Eye Institute, Keck School of Medicine of the University of Southern California, Los Angeles, California, U.S.A

Abstract

Aim: To compare the retinal morphologic characteristics of eyes with choroidal neovascularization (CNV) secondary to pathologic myopia versus eyes with CNV secondary to age-related macular degeneration (AMD), using quantitative optical coherence tomography (OCT) subanalysis.

Methods: Twenty-one eyes of 21 patients newly diagnosed with CNV secondary to pathologic myopia, and 43 consecutive cases of eyes with newly diagnosed subfoveal CNV secondary to AMD were retrospectively collected. In all patients, StratusOCT images and fluorescein angiograms (FA) were available for analysis. StratusOCT images were analyzed using custom software (termed “OCTOR”), which allowed calculation of the thickness/volume of the neurosensory retina, subretinal

Corresponding Author: Srinivas R. Sadda Doheny Image Reading Center, Doheny Eye Institute, Keck School of Medicine of the University of Southern California, 1450 San Pablo Street, DEI 3623 Los Angeles, CA 90033, U.S.A Telephone: (323) 442-6503 Fax: (323) 442-6460 Email: sadda@usc.edu.

LICENCE FOR PUBLICATION:

The Corresponding Author has the right to grant on behalf of all authors, and does grant on behalf of all authors, an exclusive licence on a worldwide basis to the BMJ Publishing Group Ltd to permit this article (if accepted) to be published in BJO and any other BMJ PGL products and sublicences such use and exploit all subsidiary rights, as set out in our licence (<http://bjo.bmj.com/fora/licence.pdf>).

COMPETING INTERESTS:

Drs. Walsh and Sadda are co-inventors of Doheny intellectual property related to spectral domain optical coherence tomography that has been licensed by Topcon Medical Systems. However, it is not related to the article's subject matter.

fluid (SRF), subretinal tissue (SRT), and pigment epithelial detachments (PEDs). FA images were used to calculate CNV leakage area and CNV lesion size for each eye.

Results: Total volume of neurosensory retina in the pathologic myopia group was significantly less than in the AMD group ($7.10 \pm 0.50 \text{ mm}^3$ versus $7.76 \pm 0.93 \text{ mm}^3$, $P=0.004$). Total volume of SRF in the pathologic myopia group was less than in the AMD group, however the difference was not statistically significant ($0.33 \pm 1.38 \text{ mm}^3$ versus $0.55 \pm 0.82 \text{ mm}^3$, $P=0.434$). Total volume of SRT in the pathologic myopia group was less than in the AMD group, however the difference was not statistically significant ($0.16 \pm 0.15 \text{ mm}^3$ versus $0.36 \pm 0.60 \text{ mm}^3$, $P=0.144$). Total volume of PED in the pathologic myopia group was markedly less than in the AMD group ($0.01 \pm 0.03 \text{ mm}^3$ versus $1.09 \pm 1.89 \text{ mm}^3$, $P<0.001$). On FA, the total leakage of CNV in the AMD group was significantly greater than in the pathologic myopia group ($4.17 \pm 3.29 \text{ DAs}$ versus $0.53 \pm 0.58 \text{ DAs}$, $P<0.001$).

Conclusions: CNV lesions in pathologic myopia were associated with considerably less retinal edema, SRF, and SRT compared with CNV associated with AMD. PEDs were almost negligible in myopic lesions compared with AMD. These findings are consistent with previous clinical and angiographic descriptions of myopic CNV as relatively small lesions with modest exudation.

Keywords

Pathologic myopia; Choroid neovascularization; Optical coherence tomography; Age-related macular degeneration

Pathologic myopia is a major cause of legal blindness in many developed countries, and is especially common in Asian populations.¹⁻³ Pathologic myopia is associated with progressive elongation of the globe, which may be accompanied by degenerative changes in the sclera, choroid, Bruch's membrane, retinal pigment epithelium (RPE), and neurosensory retina.⁴⁻⁵ The most common vision-threatening complication of pathologic myopia is the development of choroidal neovascularization (CNV) at the macula, and, in many countries, pathologic myopia is the commonest cause of CNV in younger patients.⁶⁻⁸

Photodynamic therapy with verteporfin is currently the only treatment with proven efficacy in reducing visual loss from myopic CNV;⁹ however, a number of recently published studies have evaluated the use of intravitreal bevacizumab in patients with myopic CNV.¹⁰⁻¹³ In these studies, the efficacy of treatment was chiefly determined by assessing visual acuity outcomes; however, optical coherence tomography (OCT) measurements obtained from StratusOCT (Carl Zeiss Meditec, Dublin, CA) were also used as secondary outcome parameters.

While commonly used StratusOCT software is capable of providing information regarding retinal thickness at the macula, it is unable to provide quantitative information regarding other morphologic features of CNV, such as retinal cysts, subretinal fluid (SRF) and pigment epithelial detachments (PEDs). Furthermore, the limited quantitative information, that is available, is frequently misleading due to inaccurate detection of the inner and outer boundaries of the retina.¹⁴⁻¹⁶

In an effort to obtain quantitative information regarding other morphologic characteristics of CNV, and to improve the accuracy of retinal thickness measurements, we developed a software tool (termed "OCTOR") that allows the user to manually position pre-specified boundaries on OCT B-scans, and thus quantify any morphologic space of interest. Grading rules and conventions for delineating OCT morphologic features in CNV secondary to AMD have been previously reported.¹⁷⁻¹⁸ In this report, we use OCTOR software to provide quantitative information regarding the morphologic characteristics of CNV secondary to pathologic myopia, and compare these findings with those of CNV secondary to AMD.

METHODS

Data Collection

Data from consecutive patients newly diagnosed with CNV secondary to pathologic myopia, or CNV secondary to AMD, were collected. The inclusion criteria for patients with CNV secondary to pathologic myopia were: subfoveal CNV, age range of 18-50 years, either an axial length > 26.5 mm or refractive error < -6.00 diopters, and no other apparent cause of CNV. For inclusion in the AMD group, patients had to be at least 50 years of age, have subfoveal CNV, have drusen with no other apparent cause of CNV, and have no history of previous treatment for subfoveal CNV in the study eye. Approval for data collection and analysis was obtained from the institutional review board of the University of Southern California. The research adhered to the tenets set forth in the Declaration of Helsinki.

Patients in both the pathologic myopia and AMD groups were required to have StratusOCT imaging performed at the initial diagnosis of CNV. Images were obtained using the Radial Lines protocol of 6 high-resolution B-scans on a single StratusOCT machine. Data for each case were exported to disk using the export feature available in the StratusOCT version 4.0 analysis software. Fluorescein angiographic images taken for each patient at the time of diagnosis were also collected.

Computer-Assisted Grading Software

The software used for OCT analysis (OCTOR) was written by Doheny Image Reading Center software engineers to facilitate viewing and manual grading. OCTOR is publicly accessible at <http://www.driamd.org> and has been described and validated in previous reports.¹⁷⁻¹⁹ This software, which effectively operates as a painting program and calculator, imports data exported from the StratusOCT machine and allows the grader to use a computer mouse to draw various boundaries in the retinal cross-sectional images.

After the grader draws the required layers in each of the 6 B-scans, the software calculates the distance in pixels between the manually drawn boundary lines for each of the various defined spaces. Using the dimensions of the B-scan image, the calculated pixels are converted into micrometers to yield a thickness measurement at each location. The thickness at all unsampled locations between the radial lines is then interpolated based on a polar approximation to yield a thickness map analogous to the StratusOCT output data. After interpolation, thickness values are converted into volumes (mm³) by multiplying the average thickness measurement by the sampled area. The interpolation algorithm, intergrader reliability, and intragrader reproducibility have previously been validated.¹⁷⁻¹⁸

Analogous to the StratusOCT software, OCTOR provides a report showing the calculated thickness and volume values for the 9 Early Treatment Diabetic Retinopathy Study macular subfields. The means and standard deviations of the foveal center point (FCP) thickness are also calculated. In contrast to the StratusOCT output, OCTOR provides separate maps for the various macular spaces (e.g. retina, SRF, SRT, and PED).

Grading Procedures

OCT scans were analyzed by certified OCT graders at the Doheny Image Reading Center (PAK, KTC). Boundaries drawn in each of the 6 OCT B-scans included the internal limiting membrane, outer border of the photoreceptors, borders of SRF and SRT (if present), inner surface of the RPE and estimated normal position of the RPE layer (in cases of RPE elevation), (Figure 1). All boundaries were drawn in accordance with the standard OCT grading protocol of the Doheny Image Reading Center.

After completion of the grading, OCTOR was used to calculate output parameters for the various spaces: retina, SRF, SRT, and PED. In addition, the combined parameters, inner retinal surface height from the RPE ("Height from RPE") and inner retinal surface height from the choroid ("Height from Choroid"), were also calculated.

FA images were graded independently by certified FA graders at the Doheny Image Reading Center (PAK, KTC) using the Treatment of Age-Related Macular Degeneration with Photodynamic Therapy (TAP) Study grading protocol.²⁰ Disagreement regarding angiographic classification of CNV lesion type was resolved by open adjudication.

Statistical Methods

The mean and standard deviation of the FCP thickness, as well as the total volume (subfields 1-9), were calculated for each space in each case. Volume was measured in cubic millimeters while thickness was measured in micrometers. For the comparison between pathologic myopia and AMD groups a *t* test (2-tail distribution) or Mann-Whitney rank sum test was used, depending on whether the data matched the pattern expected in a population with a normal distribution. P values < 0.05 were considered statistically significant. Statistical analysis was performed using commercially available software (Intercooled Stata for Windows, Version 9, Statacorp LP, USA).

RESULTS

A total of 64 cases were included in this study: 21 cases of CNV secondary to pathologic myopia, and 43 cases of CNV secondary to AMD. StratusOCT images were obtained using the Radial Lines protocol for all cases of CNV secondary to both pathologic myopia and AMD.

Angiographic classification of CNV type was performed for both groups. In the pathologic myopia group, 19 cases were classified as predominantly classic CNV lesions, while two cases were classified as occult CNV lesions. In the AMD group, 14 cases displayed classic angiographic features (7 predominantly classic; 7 minimally classic), while 29 cases were classified as occult CNV lesions.

Morphologic Data derived from Fluorescein Angiography

The total area of CNV lesions in the AMD group was significantly greater than in the pathologic myopia group (6.04 ± 5.16 Disc Areas (DAs) versus 0.73 ± 0.85 DAs $P < 0.001$). The total leakage of CNV lesions in the AMD group was also significantly greater than in the pathologic myopia group (4.17 ± 3.29 DAs versus 0.53 ± 0.58 DAs $P < 0.001$). The greatest linear dimension (GLD) of CNV lesions secondary to AMD was significantly greater than CNV lesions secondary to pathologic myopia (4.11 ± 1.64 mm versus 1.48 ± 0.75 mm $P < 0.001$). The GLD of CNV leakage in the AMD group was significantly greater than CNV leakage in the pathologic myopia group (3.76 ± 1.52 mm versus 1.37 ± 0.75 mm $P < 0.001$).

Morphologic Data derived from OCTOR Analysis

OCT parameters calculated by OCTOR after manual grading are summarized in Figures 2 and 3.

Neurosensory Retina—Total volume of the neurosensory retina in the pathologic myopia group was significantly less than that in the AMD group (7.10 ± 0.50 mm³ versus 7.76 ± 0.93 mm³, $P = 0.004$). The thickness of the neurosensory retina at the FCP in the pathologic myopia group was less than that in the AMD group but the difference was not statistically significant (240.10 ± 47.75 μm versus 280.81 ± 123.75 μm, $P = 0.142$).

Subretinal Fluid—Total volume of SRF in the pathologic myopia group was less than that in the AMD group, however the difference was not statistically significant ($0.33 \pm 1.38 \text{ mm}^3$ versus $0.55 \pm 0.82 \text{ mm}^3$, $P=0.434$). The thickness of SRF at the FCP in the pathologic myopia group was less than that in the AMD group, however the difference was also not statistically significant ($19.33 \pm 55.53 \text{ }\mu\text{m}$ versus $32.56 \pm 54.93 \text{ }\mu\text{m}$, $P=0.371$).

Subretinal Tissue—Total volume of SRT in the pathologic myopia group was less than that in the AMD group, however the difference was not statistically significant ($0.16 \pm 0.15 \text{ mm}^3$ versus $0.36 \pm 0.60 \text{ mm}^3$, $P=0.144$). In contrast, the thickness of SRT at the FCP in the pathologic myopia group was greater than that in the AMD group ($119.24 \pm 75.72 \text{ }\mu\text{m}$ versus $64.07 \pm 121.11 \text{ }\mu\text{m}$, $P=0.061$).

Pigment Epithelial Detachment—Total volume of PED in the pathologic myopia group was markedly less than that in the AMD group ($0.01 \pm 0.03 \text{ mm}^3$ versus $1.09 \pm 1.89 \text{ mm}^3$, $P<0.001$). The thickness of PED at the FCP in the pathologic myopia group was also markedly less than that in the AMD group ($8.29 \pm 21.01 \text{ }\mu\text{m}$ versus $93.88 \pm 130.42 \text{ }\mu\text{m}$, $P<0.001$).

Inner Retinal Surface Height from the RPE—Total volume of “Height from the RPE” in the pathologic myopia group was significantly less than that in the AMD group ($7.30 \pm 0.57 \text{ mm}^3$ versus $8.67 \pm 1.71 \text{ mm}^3$, $P<0.001$). The thickness of the “Height from the RPE” at the FCP in the pathologic myopia group was less than that in the AMD group, however the difference was not statistically significant ($366.67 \pm 88.58 \text{ }\mu\text{m}$ versus $378.51 \pm 198.71 \text{ }\mu\text{m}$, $P=0.795$).

Inner Retinal Surface Height from the Choroid (spanning the distance from the ILM to the base of any PED)—Total volume of “Height from the Choroid” in the pathologic myopia group was significantly less than that in the AMD group ($7.31 \pm 0.58 \text{ mm}^3$ versus $9.76 \pm 2.59 \text{ mm}^3$, $P<0.001$). The thickness of the “Height from the Choroid” at the FCP in the pathologic myopia group was also significantly less than that in the AMD group ($374.95 \pm 78.29 \text{ }\mu\text{m}$ versus $472.23 \pm 203.89 \text{ }\mu\text{m}$, $P=0.039$).

DISCUSSION

In this study, we performed a quantitative comparison of the morphology of CNV in pathologic myopia versus that of CNV in AMD, using publicly available, custom OCT grading software (OCTOR).

OCTOR analysis demonstrated that the total volume of the neurosensory retina was significantly less in patients with CNV secondary to pathologic myopia as compared to patients with CNV secondary to AMD. Moreover, the thickness of the neurosensory retina at the FCP was also significantly less in the pathologic myopia group ($240.10 \text{ }\mu\text{m}$) compared to the AMD group ($309.38 \text{ }\mu\text{m}$). These findings may reflect reduced exudation associated with myopic CNV, and thus decreased levels of intraretinal edema in the form of cystic space formation or diffuse “spongy” retinal thickening. Conversely, myopic CNV is known to occur in areas of geographic atrophy of the RPE,^{21,22} and the relative difference in retinal thickening may reflect pre-existing attenuation of the neurosensory retina rather than any real difference in the permeability of vessels forming the choroidal neovascular membrane.²¹ The photoreceptor-external limiting membrane complex of younger patients with myopic CNV might also be more resistant to disruption by the underlying lesion and thus less likely to allow intraretinal fluid accumulation. Other studies, incorporating measurements of central retinal thickness as anatomic outcome measures, have reported mean baseline thicknesses ranging from $198.4 \text{ }\mu\text{m}$ to $385.43 \text{ }\mu\text{m}$.¹⁰⁻¹³ Direct comparison is difficult however, as many of these studies included patients who had been pre-treated with photodynamic therapy and other therapeutic

modalities. Furthermore, caution is necessary when interpreting these results as StratusOCT software typically combines the subretinal space with the neurosensory retina in thickness calculations. Consequently, in this study we also evaluated the combined parameter of inner retinal surface height from the RPE, which is more easily comparable to automated StratusOCT analysis. The total volume of the “Height from the RPE”, as determined using OCTOR software, was markedly less in the pathologic myopia group than in the AMD group.

The total volume of fluid in the subretinal space, as well as the thickness of SRF at the FCP, was less in patients with myopic CNV than in patients with CNV secondary to AMD, although the difference was not statistically significant. On FA, myopic CNV lesions were generally smaller in area, and associated with less leakage, than CNV secondary to AMD. The finding that myopic CNV lesions demonstrate less leakage on FA supports the thesis that these membranes produce less exudate. Reduced leakage of fluid from the CNV complex into the subretinal space in pathologic myopia may be a function of the attenuated blood supply to the thin choroid in these patients.^{21,23} Alternatively, it is possible that, for a given lesion size, myopic CNV results in a similar volume of exudation to CNV in AMD, and that the RPE in myopic eyes is more efficient at pumping fluid out of the subretinal space.

We assigned the generic label “subretinal tissue” to any hyperreflective material in the subretinal space. When assessing the results of this analysis, it is critical to note that the total volume of SRT cannot be assumed to be equivalent to the total volume of a type 2 CNV complex, as hyperreflective material in the subretinal space may also include hemorrhage, lipid, thick fibrin, or scar tissue. However, in most cases of myopic CNV, any associated hemorrhage tends to be localized and insubstantial,⁷ and the SRT volume may be a fair representation of the choroidal neovascular complex. In our study, the total volume of SRT was less in patients with myopic CNV than in patients with CNV secondary to AMD, although the difference was not statistically significant. Interestingly, there was a significantly greater thickness of SRT at the FCP in patients with myopic CNV, perhaps representative of the focal choroidal neovascular membranes occurring at small linear breaks in Bruch's membrane (lacquer cracks).^{22, 24}

In our study, the total volume and FCP thickness of PEDs was almost negligible in myopic CNV lesions in comparison with CNV lesions secondary to AMD. This finding is consistent with previous clinical observation, by Gass and others, that PEDs occur infrequently in patients with myopic CNV.²¹ In neovascular AMD, evidence suggests that CNV displaying a classic angiographic pattern is predominantly composed of subretinal fibrovascular tissue directly external to the neurosensory retina (and internal to the RPE), while CNV displaying an occult pattern frequently corresponds with fibrovascular tissue located external to the RPE.²⁵ Our study of CNV in pathologic myopia provides further support for this hypothesis as 19 of the 21 pathologic myopia cases were classified as “predominantly classic” CNV lesions on fluorescein angiography, and were associated with minimal PED space.

In this study, we also report the thickness of each morphologic space at the FCP, primarily because clinical trials typically utilize StratusOCT-generated foveal central subfield or FCP retinal thickness values as their OCT secondary outcome measures.^{26,27} However, even in cases of accurate boundary detection, these parameters may be erroneous, due to failure of scans to pass through the anatomical center of the fovea, or due to the presence of eccentrically positioned neovascular lesions. Therefore, we believe that consideration of the total volume of each morphologic space is preferable to the calculation of thickness at a single point or subfield, and manual grading with OCTOR software facilitates this consideration.

Recent improvements in OCT imaging resolution have enhanced the accuracy of OCT interpretation, and these advances have been corroborated in part by histologic studies in

monkeys.^{28,29} However, there remains a lack of histologic correlation in diseased human eyes, and, therefore, it is not yet possible to identify definitively all hypo- and hyperreflective structures seen in an OCT B-scan. As a result, we developed conventions based on the available literature and previous reading center experience in OCT interpretation to establish grading rules for the array of complex lesions in neovascular AMD. The reproducibility of these rules has been described elsewhere.¹⁸

There is a dearth of studies evaluating the histologic appearances of pathologic myopia, and in particular of myopic CNV.³⁰ In the absence of these studies, manual grading with OCTOR software may represent a first step in quantifying the morphology of CNV secondary to pathologic myopia. With the recent introduction of new therapeutic modalities for myopic CNV,¹⁰⁻¹³ quantitative subanalysis may also prove useful for the interpretation of anatomic outcomes following treatment, and analyzing their correlation with visual acuity.

Acknowledgments

FUNDING:

Supported in part by NIH Grant EY03040 and NEI Grant R01 EY014375

Abbreviations

AMD, age-related macular degeneration; CNV, choroidal neovascularization; OCT, optical coherence tomography; SRF, subretinal fluid; PED, pigment epithelial detachment; RPE, retinal pigment epithelium; SRT, subretinal tissue; FCP, foveal center point; DA, disc area; GLD, greatest linear dimension.

REFERENCES

1. Tano Y. Pathologic myopia: where are we now? *Am. J. Ophthalmol* 2002;134:645–60. [PubMed: 12429239]
2. Curtin, BJ. The Myopias: Basic Science and Clinical Management. Harper and Row; Philadelphia: 1985. The nature of pathologic myopia; p. 237-45.
3. Sperduto RD, Seigel D, Roberts J, et al. Prevalence of myopia in the United States. *Arch Ophthalmol* 1983;101:405–7. [PubMed: 6830491]
4. Noble KG, Carr RE. Pathologic myopia. *Ophthalmology* 1982;89:1099–100. [PubMed: 7177575]
5. Curtin BJ, Karlin DB. Axial length measurements and fundus changes of the myopic eye. *Am. J. Ophthalmol* 1971;1:42–53. [PubMed: 5099937]
6. Cohen SY, Laroche A, Leguen Y, et al. Etiology of choroidal neovascularization in young patients. *Ophthalmology* 1996;103:1241–4. [PubMed: 8764794]
7. Avila MP, Weiter JJ, Jalkh AE, et al. Natural history of choroidal neovascularization in degenerative myopia. *Ophthalmology* 1984;91:1573–81. [PubMed: 6084222]
8. Hampton GR, Kohen D, Bird AC. Visual prognosis of disciform degeneration in myopia. *Ophthalmology* 1983;90:923–6. [PubMed: 6195574]
9. Verteporfin in Photodynamic Therapy (VIP) Study Group. Photodynamic therapy of subfoveal choroidal neovascularization in pathologic myopia with verteporfin. 1-year results of a randomized clinical trial--VIP report no. 1. *Ophthalmology* 2001;108:841–52. [PubMed: 11320011]
10. Yamamoto I, Rogers AH, Reichel E, et al. Intravitreal bevacizumab (Avastin) as treatment for subfoveal choroidal neovascularisation secondary to pathological myopia. *The British Journal of Ophthalmology* 2007;91:157–60. [PubMed: 16870653]
11. Sakaguchi H, Ikuno Y, Gomi F, et al. Intravitreal injection of bevacizumab for choroidal neovascularisation associated with pathological myopia. *The British Journal of Ophthalmology* 2007;91:161–5. [PubMed: 16914470]

12. Chan WM, Lai TY, Liu DT, et al. Intravitreal Bevacizumab (Avastin) for Myopic Choroidal Neovascularization Six-Month Results of a Prospective Pilot Study. *Ophthalmology* 2007;114:2190–6. [PubMed: 17599414]
13. Hernández-Rojas ML, Quiroz-Mercado H, Dalma-Weiszhausz J, et al. Short-term effects of intravitreal bevacizumab for subfoveal choroidal neovascularization in pathologic myopia. *Retina* 2007;27:707–12. [PubMed: 17621179]
14. Sadda SR, Wu Z, Walsh AC, et al. Errors in retinal thickness measurements obtained by optical coherence tomography. *Ophthalmology* 2006;113:285–93. [PubMed: 16406542]
15. Ray R, Stinnett SS, Jaffe GJ. Evaluation of image artifact produced by optical coherence tomography of retinal pathology. *Am J Ophthalmol* 2005;139:18–29. [PubMed: 15652824]
16. Hee MR. Artifacts in optical coherence tomography topographic maps. *Am J Ophthalmol* 2005;139:154–5. [PubMed: 15652841]
17. Sadda SR, Joeres S, Wu Z, et al. Error correction and quantitative subanalysis of optical coherence tomography data using computer-assisted grading. *Invest Ophthalmol Vis Sci* 2007;48:839–48. [PubMed: 17251486]
18. Joeres S, Tsong JW, Updike PG, et al. Reproducibility of quantitative optical coherence tomography subanalysis in neovascular age-related macular degeneration. *Invest Ophthalmol Vis Sci* 2007;48:4300–7. [PubMed: 17724220]
19. Keane PA, Liakopoulos S, Ongchin SC, et al. Quantitative subanalysis of optical coherence tomography after treatment with ranibizumab for neovascular age-related macular degeneration. *Invest Ophthalmol Vis Sci*. April 11;2008 Epub ahead of print
20. Barbazetto I, Burdan A, Bressler NM, et al. Photodynamic therapy of subfoveal choroidal neovascularization with verteporfin: fluorescein angiographic guidelines for evaluation and treatment – TAP and VIP report No. 2. *Arch Ophthalmol* 2003;121:1253–68. [PubMed: 12963608]
21. Gass, JD. Stereoscopic Atlas of Macular Diseases: Diagnosis and Treatment. Vol. 4th Edn.. Vol. 1. CV Mosby; St. Louis: 1997. Chapter 3
22. Ohno-Matsui K, Yoshida T, Futagami S, et al. Patchy atrophy and lacquer cracks predispose to the development of choroidal neovascularization in pathological myopia. *The British Journal of Ophthalmology* 2003;87:570–3. [PubMed: 12714395]
23. Avetisov ES, Savitskaya NF. Some features of ocular microcirculation in myopia. *Ann Ophthalmology* 1977;9:1261–4.
24. Klein RM, Green S. The development of lacquer cracks in pathologic myopia. *Am J Ophthalmol* 1988;106(3):282–5. [PubMed: 3421288]
25. Lafaut BA, Bartz-Schmidt KU, Vanden Broecke C, Aisenbrey S, et al. Clinicopathological correlation in exudative age related macular degeneration: histological differentiation between classic and occult choroidal neovascularisation. *The British Journal of Ophthalmology* 2000;84:239–43. [PubMed: 10684831]
26. Fung AE, Lalwani GA, Rosenfeld PJ, et al. An optical coherence tomography-guided, variable dosing regimen with intravitreal ranibizumab (Lucentis) for neovascular age-related macular degeneration. *Am J Ophthalmol* 2007;143:566–83. [PubMed: 17386270]
27. Kaiser PK, Blodi BA, Shapiro H, et al. Angiographic and optical coherence tomographic results of the MARINA study of ranibizumab in neovascular age-related macular degeneration. *Ophthalmology* 2007;114:1868–75. [PubMed: 17628683]
28. Anger EM, Unterhuber A, Hermann B, et al. Ultrahigh resolution optical coherence tomography of the monkey fovea. Identification of retinal sublayers by correlation with semithin histology sections. *Exp Eye Res* 2004;78:1117–25. [PubMed: 15109918]
29. Toth CA, Narayan DG, Boppart SA, et al. A comparison of retinal morphology viewed by optical coherence tomography and by light microscopy. *Arch Ophthalmol* 1997;115:1425–8. [PubMed: 9366674]
30. Grossniklaus HE, Green WR. Pathologic findings in pathologic myopia. *Retina* 1992;12:127–33. [PubMed: 1439243]

Figure 1.

Optical coherence tomography B-scan of an eye with CNV secondary to pathologic myopia. (A) Raw scan image, (B) the clinically relevant boundaries (internal limiting membrane, outer photoreceptor border, retinal pigment epithelium [RPE], and both the inner and outer borders of subretinal tissue) are graded using OCTOR (computer-assisted manual grading) software, which then computes the volumes of the spaces (retina, SRF, and SRT) defined by these boundaries (C).

Figure 2. Quantitative information supplied by OCTOR (computer-assisted optical coherence tomography grading software). **(A)** Thickness at the foveal center point (FCP) of neurosensory retina, “Height from RPE”, and “Height from Choroid”. **(B)** Total volume of neurosensory retina, “Height from RPE”, and “Height from Choroid”. *P<0.05.

Figure 3.

Quantitative information supplied by OCTOR (computer-assisted optical coherence tomography grading software). **(A)** Thickness at the foveal center point (FCP) of subretinal fluid, subretinal tissue, and pigment epithelium detachment. **(B)** Total volume of subretinal fluid, subretinal tissue, and pigment epithelium detachment. *P<0.05.