ABSTRACTS

Neuro-Ophthalmic Literature Review

David A. Bellows, Noel C.Y. Chan, John J. Chen, Hui-Chen Cheng, Peter W. MacIntosh, Jenny A. Nij Bijvank, and Michael S. Vaphiades

Can OCT help us distinguish glaucoma from other optic neuropathies?

Leaney JC, Nguyen V, Miranda E, Barnett Y, Admad K, Wong S, Lawlor M. Bruch's membrane opening minimum rim width provides objective differentiation between glaucoma and nonglaucomatous optic neuropathies. *Am J Ophthalmol* 2020;218:164–172. doi: [10.1016/j.ajo.2020.05.034](https://doi.org/10.1016/j.ajo.2020.05.034)

Ischaemic, inflammatory, compressive, and hereditary optic neuropathies as well as optic disk drusen can present as “normal pressure” glaucoma. Differentiating glaucomatous from non-glaucomatous optic neuropathies is critically important for those of us who practice neuro-ophthalmology as well as those specialising in glaucoma, comprehensive ophthalmology, and neurology. This is not only important to the patient in terms of treatment and visual outcome but also to the clinician who would like to minimise his or her exposure to litigation.

The authors hypothesise that patients with non-glaucomatous optic neuropathies (NGON) can be distinguished from those with glaucomatous optic neuropathy (GON) by using optical coherence tomography (OCT) to assess the minimum rim width at Bruch's membrane opening (MRW-BMO) and the ratio of MRW-BMO to the retinal nerve fibre layer thickness (MRW-BMO:RNFL).

Twenty-seven patients with a diagnosis of normal-tension glaucoma (NTG) and 54 patients with non-glaucomatous optic neuropathies (NGON) were recruited for this study. The diagnoses included in the NGON group included both arteritic and non-arteritic anterior ischaemic optic neuropathies as well as prior optic neuritis, optic nerve drusen and hereditary optic neuropathies. The authors then compared the MRW-BMO and the

MRW-BMO:RNFL ratio of the two groups. They found that patients with NGON had both lower MRW-BMOs and MRW-BMO:RNFLs than those with GON.

The authors make the point that, based on cognitive bias, the general ophthalmologist may have a high threshold for considering non-glaucomatous optic neuropathies in patients who have optic nerve cupping and visual field loss. They maintain that incorporating MRW-BMO in the routine OCT platform may alert the clinician to consider diagnoses other than normal tension glaucoma in these patients.

David A. Bellows

MG onset: The older the better?

Cortés-Vicente E, Alvarez-Velasco R, Segovia S, Paradas C, Casasnovas C, Guerrero-Sola A, Pardo J, Ramos-Fransi A, Sevilla T, López de Munain A, Gómez MT, Jericó I, Gutiérrez- Gutiérrez G, Pelayo-Negro AL, Asunción Martín M, Mendoza MD, Morís G, Rojas-García R, Díaz-Manera J, Querol L, Gallardo E, Vélez B, Albertí MA, Galán L, García-Sobrino T, Martínez-Piñeiro A, Lozano-Veintimilla A, Fernández-Torrón R, Cano-Abascal A, Illa I. Clinical and therapeutic features of myasthenia gravis in adults based on age at onset. *Neurology*. 2020; 94(11):e1171-e1180. doi:[10.1212/WNL.0000000000008903](https://doi.org/10.1212/WNL.0000000000008903)

The presentation of myasthenia gravis (MG) is known to be heterogeneous clinically and immunologically. Various antibodies have been identified including antibodies against acetylcholine receptor (anti-AChR), muscle-specific tyrosine kinase (anti-MUSK), anti-LRP4 and anti-Cortactin. Some patients were noted to be seronegative which

makes the clinical diagnosis sometimes even more challenging.

This is an observational cross-sectional multi-centre study conducted in Spain which described the clinical, immunologic and therapeutic characteristics of myasthenic patients of different onset age. Utilizing the MG registry, 939 patients with adult-onset MG diagnosed between year 2000–2016 from 15 tertiary hospitals were included for analysis. The mean follow-up duration was 9.1 years. The authors further sub-divided the patients into early-onset (onset age <50), late-onset (onset age 50–64) and very-late-onset (onset age ≥65).

In this cohort, patients with late-onset and very-late-onset were more frequently men ($p < .0001$). These two groups more frequently had ocular MG at onset ($p < .0001$) and at maximal worsening ($p = .001$). The presence of anti-AChR antibodies was higher in the very-late-onset group ($p < .0001$) and this group has fewer thymoma ($p < .0001$). Although this most senile group presented with more life-threatening events at onset ($p = .002$), they required fewer immunosuppressants for disease control ($p < .0001$) and they were less frequently drug-refractory ($p < .0001$). Although mortality was higher in the very-late-onset MG group, there was no difference between groups in terms of causes of death. Among the three age groups, there were no differences regarding generalization frequency or diagnostic delay. For immunosuppressive therapy, the very-late-onset MG had more side effects when treated with mycophenolate mofetil than the other two groups ($p = .031$) while this difference was not observed with other immunosuppressants.

The authors observed different phenotypes between the early-onset MG and the very-late-onset MG while the late-onset MG group showed an intermediate phenotype. They hypothesised that age-related immune dysregulation was the more prominent pathogenic cause in the very-late-onset group and they observed milder disease with better general outcome in this age group.

Although this study was limited by the retrospective data sampling, the large number of patients recruited in a systemic dataset has shown interesting results. As there are racial differences in the clinical manifestations of auto-immune diseases, it will be

valuable to conduct similar observational studies in other parts of the world.

Noel C.Y. Chan

Artificial intelligence is just as good as a neuro-ophthalmologist at identifying papilloedema, but faster?

Biousse V, Newman NJ, Najjar RP, Vasseneix C, Xu X, Ting DS, Milea LB, Hwang JM, Kim DH, Yang HK, Hamann S. Optic disc classification by deep learning versus expert neuro-ophthalmologists. *Ann Neurol.* 2020. Online ahead of print. doi: [10.1002/ana.25839](https://doi.org/10.1002/ana.25839)

Study design

The investigators compared a previously trained and validated artificial intelligence deep learning system (DLS) against two expert neuro-ophthalmologists in their ability to correctly identify normal optic nerves, papilloedema, and other optic disc abnormalities based on 800 fundus photographs.

Outcomes

The DLS correctly classified 678 of 800 (84.7%) photographs, compared to 84.4% for Expert 1 and 80.1% for Expert 2. The DLS had areas under the receiver operating characteristic curve of 0.97 for detecting normal discs, 0.96 for detecting papilloedema, and 0.89 for detecting other disc abnormalities, which had equal or better accuracy, specificity, and sensitivity compared to the Experts. This task took 25 seconds for the DLS, 61 minutes for Expert 1, and 74 minutes for Expert 2.

Limitations

In this study, the classification of the optic discs was based on fundus photographs alone. In real practice, clinical examination, ancillary testing, and follow-up are important in establishing a diagnosis, which were not incorporated into the classification.

Clinical significance

This study demonstrates that DLS was equal or better than two expert neuro-ophthalmologists at classifying optic disc abnormalities and took a fraction of the time. Artificial intelligence systems, such as DLS, could be very valuable in identifying

potentially vision threatening or neurologically dangerous disease based on fundus photographs, which will be most useful in the emergency room setting or for providers that do not have rapid access to an ophthalmologist.

John J. Chen

Spaceflight may induce optic nerve lengthening

Wahlin A, Holmlund P, Fellows AM, Malm J, Buckey JC, Eklund A. Optic nerve length before and after spaceflight. *Ophthalmology*. 2020. Online ahead of print. doi: [10.1016/j.ophtha.2020.07.007](https://doi.org/10.1016/j.ophtha.2020.07.007).

The authors conducted a cohort study to investigate if microgravity can create deformations/movements of the eye or optic nerve. They enrolled 22 astronauts (age 48 ± 4 years) and co-registered pre- and post-spaceflight magnetic resonance imaging (MRI). The centerline representations of the optic nerve were generated and coordinates for the optic nerve head (ONH) and optic chiasm (OC) ends of the optic nerve were recorded. They found that optic nerve length increased, which primarily reflected forward ONH displacement. The forward displacement was positively related to mission duration, preflight body weight, and clinical manifestations of spaceflight-associated neuro-ocular syndrome (SANS). They also detected upward displacement of the OC but this observation could not be linked to SANS. The authors concluded that spaceflight-induced optic nerve lengthening and anterior movement of the ONH support that SANS is caused by an altered pressure difference between the brain and the eye, leading to a forward push on the posterior of the eye. Direct assessment of intracranial pressure in space may be required to verify the implicated mechanism of SANS.

Hui-Chen Cheng

Use of anti-hypertensive medication may be correlated with loss of ganglion cells in non-glaucomatous population

Chong RS, Chee ML, Tham YC, Majithia S, Thakur S, Teo ZL, Da Soh Z, Chua J, Tan B, Wong DW, Schmetterer L, Sabanayagam C, Cheng CY. Association of anti-hypertensive medication with retinal nerve fibre layer and ganglion cell-inner

plexiform layer thickness. *Ophthalmology*. 2020. Article in press. doi: [10.1016/j.ophtha.2020.07.051](https://doi.org/10.1016/j.ophtha.2020.07.051).

The authors conducted a population-based, cross-sectional study to evaluate the association between different classes of anti-hypertensive medication with retinal nerve fibre layer (RNFL) and ganglion cell-inner plexiform layer (GC-IPL) thickness in a non-glaucomatous multi-ethnic Asian population. They enrolled a total of 9,144 eyes for RNFL analysis (2,668 Malays, 3,554 Indians and 2,922 Chinese) and 8,549 eyes for GC-IPL analysis (2,460 Malays, 3,230 Indians and 2,859 Chinese) from patients aged 44 to 86 years. They found that participants on any type of anti-hypertensive medication or specifically, angiotensin-converting enzyme-inhibitors (ACEI) or diuretics, had thinner average RNFLs, compared with participants who were not on anti-hypertensive treatment. Use of a greater number of anti-hypertensive medication was significantly associated with thinner average RNFLs. A similar trend was noted in macular GC-IPL thickness. The authors concluded that use of two or more anti-hypertensive medications were associated with a loss of structural markers of retinal ganglion cell health, which may imply potential vulnerability of retinal ganglion cells to drug-induced blood pressure alterations.

Hui-Chen Cheng

Visual impairment in high flow and low flow carotid cavernous fistula

Alam SM, Jain M, Mukherjee B, Sharma T, Halbe S, Jainsankar D, Raman R. Visual impairment in high flow and low flow carotid cavernous fistula. *Sci Rep*. 2019; 9(1):12872

The authors performed a retrospective study of 48 patients who underwent digital subtraction angiography (DSA) to evaluate the varied posterior segment manifestations, level of visual impairment and its causes in patients with carotid cavernous fistula (CCF). The CCFs were classified according to Barrow *et al.* based on DSA into Type A (high flow), or Types B, C, D (low flow).

Of the 48 patients, eight (16.76%) had high flow CCFs and 40 (83.3%) had low flow CCFs, with mean ages in years of 26.6 and 50.3, respectively, and the high flow patients were more likely to have

had trauma. Both groups had six males each, representing 75% in the high flow and 55% in the low flow groups. In the high flow group, 12.5% were bilateral, versus 8.1% in the low flow group. The majority of low flow CCFs were Type D, followed by Type C then Type B.

The retinal manifestations ranged from mild stasis retinopathy to frank central retinal vein occlusion (CRVO) and optic neuropathy from glaucoma and ischaemic changes. More rare findings included central retinal artery occlusion (CRAO), Terson syndrome and combined retinal/choroidal detachment. The most common finding was retinal venous dilatation, present in 62.5% of high flow and 52.5% of low flow patients.

The causes of vision impairment in the high flow group were: traumatic optic neuropathy (33%), vitreous haemorrhage (16.7%), CRAO (16.7%), glaucomatous optic neuropathy (16.7%) and ischaemic optic neuropathy (16.7%). The causes of vision impairment in the low flow group were: stasis retinopathy (50%), CRVO (20%), glaucomatous optic neuropathy (10%), ischaemic optic neuropathy and combined choroidal and retinal detachment (10%).

This study identified the “3 point sign” which was a novel finding by the authors. It describes three findings: disc hyperaemia; retinal vein dilatation and intra-retinal haemorrhage as being predictive of visual loss when present together.

The limitations of the study include its retrospective nature, small number of patients, and single centre study design.

Peter W. MacIntosh

Easy tests provide valuable information after acute demyelinating optic neuritis

Klineova S, Kupersmith M. Promising recovery biomarkers after first event acute demyelinating optic neuritis. *Mult Scler Relat Disord.* 2020;45:102400. doi: [10.1016/j.msard.2020.102400](https://doi.org/10.1016/j.msard.2020.102400).

This observational study aimed to confirm the role of ganglion cell layer (GCL) thickness and low contrast visual acuity (LCVA) as biomarkers of residuals deficits after a first episode of acute demyelinating optic neuritis and proposed the use of a new outcome measure, 10–2 mean deviation (MD) threshold perimetry.

A total of 32 participants were included within 15 days after a first attack of acute demyelinating optic neuritis. All study participants received treatment as usual. At baseline and after 6 months, optical coherence tomography, visual acuity measurement (high and low contrast) and 10–2 MD perimetry were performed. At baseline, there were significant deficits in LCVA in the affected eyes (1.6 ± 7.4 letters seen), in comparison to the fellow eyes (31.6 ± 12.4 letters seen). At 6 months there were still residual LCVA deficits (12.6 ± 15.8 letters seen in the study eyes versus 34.1 ± 10.6 in the fellow eyes, $p = .001$). 10–2 MD threshold perimetry also showed a difference between affected eyes and fellow eyes, which was significant at 6 months (-4.26 ± 3.99 dB and -1.38 ± 1.39 dB respectively, $p = .01$). GCL thickness in the affected eye at baseline was normal relative to the fellow eyes, but there was a significant reduction after 6 months (affected eyes 69.6 ± 9.6 μ m, fellow eyes 82.7 ± 4.7 μ m, $p = .001$). Correlation analyses demonstrated that particularly GCL thinning had a strong correlation with the 10–2 MD after 6 months.

This study showed that 10–2 MD perimetry, rather than previously investigated 30–2 or 24–2 visual field testing, is an additional marker of visual deficit after an episode of demyelinating optic neuritis. Although high contrast visual acuity frequently returns to normal after acute demyelinating optic neuritis, LCVA deficits often remain. Even though the sample size was modest and follow-up period relatively small, this study shows that a set of biomarkers can provide valuable information after an event of acute demyelinating optic neuritis.

Jenny A. Nij Bijvank

Neuromyelitis optica spectrum disorder: A case report of effective combination immunosuppressant, corticosteroids, and therapeutic plasma exchange

Tambunan L, Ritarwan K, Surbakti KP. Neuromyelitis optica spectrum disorder: A case report of effective combination immunosuppressant, corticosteroids, and therapeutic plasma exchange. *Open Access Maced J Med Sci.* 2019;7-(20):3433–3436. doi:[10.3889/oamjms.2019.439](https://doi.org/10.3889/oamjms.2019.439)

Neuromyelitis optica spectrum disorder (NMOSD) is an autoimmune disease that causes

severe demyelination, acute optic neuritis and transverse myelitis. The authors report a case of NMOSD and review the disorder. Their case is a 22-year-old man with quadriplegia, urinary incontinence, dyspnoea and visual loss. Spinal magnetic resonance imaging (MRI) showed longitudinal extensive transversal myelitis. The brain MRI was normal, however, brain magnetic resonance spectroscopy showed demyelination. The serum antibody AQP4 (AQP4-IgG) results were seronegative, the cerebrospinal fluid examination was normal, and the oligoclonal band were negative. The ophthalmoscopic examination found bilateral optic atrophy. Somatosensory evoked potential and visual evoked potential examinations were abnormal. The patient was diagnosed with NMOSD and prescribed immunosuppressant therapy, corticosteroids, and therapeutic plasma exchange with significant clinical improvement. This paper reviews NMOSD, the typical clinical presentation, diagnosis, treatment and prognosis.

Michael S. Vaphiades

Ecilizumab improves fatigue in refractory generalized myasthenia gravis

Ecilizumab improves fatigue in refractory generalized myasthenia gravis. Andersen H, Mantegazza R, Wang JJ, O'Brien F, Patra K, Howard JF Jr, REGAIN Study Group. *Qual Life Res.* 2019;28:2247–2254.

The authors performed a 26-week, phase 3, randomised, double-blind, placebo-controlled study evaluating ecilizumab efficacy and safety. They wanted to evaluate the effect of ecilizumab on perceived fatigue in patients with anti-acetylcholine receptor antibody-positive (AChR+), refractory, generalized myasthenia gravis (MG) using the Quality of Life in Neurological Disorders (Neuro-QOL) Fatigue subscale, and to evaluate correlations between improvements in Neuro-QOL Fatigue and other clinical endpoints.

In the REGAIN study, week 26, ecilizumab-treated patients showed significantly greater improvements in Neuro-QOL Fatigue scores than placebo-treated patients. Improvements with ecilizumab were sustained through subsequent open-label extension week 52. The authors concluded that

compared with placebo, ecilizumab was associated with improvements in perceived fatigue that strongly correlated with improvements in MG-specific outcome measures and that their results contribute to the consistency and totality of the data demonstrating that ecilizumab lowers the clinical burden in patients with AChR+ refractory generalized MG.

Michael S. Vaphiades

Miller Fisher syndrome and polyneuritis cranialis in COVID-19

Gutiérrez-Ortiz C, Méndez-Guerrero A, Rodrigo-Pay S, San Pedro-Murillo E, Bermejo-Guerrero L, Gordo-Mañas R, de Aragón-Gómez F, Benito-León J. Miller Fisher syndrome and polyneuritis cranialis in COVID-19. *Neurology.* 2020;95(5):e601–e605. doi:10.1212/WNL.0000000000009619.

The authors report two patients with severe acute respiratory syndrome from coronavirus (COVID-19) who presented acutely with Miller Fisher syndrome and polyneuritis cranialis respectively. The first patient was a 50-year-old man who presented with cough, malaise, headache, low back pain, and fever. Five days later he developed anosmia, ageusia, right internuclear ophthalmoparesis, right fascicular oculomotor palsy, ataxia, areflexia, albuminocytologic dissociation, and positive testing for anti-GD1b-immunoglobulin G antibody. The second was a 39-year-old man who presented with diarrhoea and a low-grade fever. Three days later he developed ageusia, bilateral abducens palsy, areflexia, and albuminocytologic dissociation. The first patient was treated with IV immunoglobulin and the second with acetaminophen. Two weeks later, both patients made a complete neurologic recovery, except for residual anosmia and ageusia in the first case. The main limitation of each of the cases was the absence of electromyography and nerve conduction studies as well as magnetic resonance imaging (to detect nerve enhancement). The reason for this was the extreme circumstances in their hospitals at the peak of this pandemic. The authors concluded that their two cases highlight the rare occurrence of Miller Fisher syndrome and polyneuritis cranialis during the COVID-19 pandemic. These neurologic manifestations may occur because of an aberrant immune response to

COVID-19 and that the full clinical spectrum of neurologic symptoms in patients with COVID-19 remains to be characterised.

Michael S. Vaphiades

COVID-19 presenting with ophthalmoparesis from cranial nerve palsy

Dinkin M, Gao V, Kahan J, Bobker S, Simonetto M, Wechsler P, Harpe J, Greer C, Mints G, Salama G, Tsiouris AJ, Leifer D. COVID-19 presenting with ophthalmoparesis from cranial nerve palsy. *Neurology*. 2020;95(5):221–223. doi: [10.1212/WNL.0000000000009700](https://doi.org/10.1212/WNL.0000000000009700).

The authors describe two patients who developed cranial neuropathies within days of respiratory symptoms related to SARS-CoV-2 infection. The first case was a 36-year-old man with a history of infantile strabismus who presented with left ptosis, diplopia, and bilateral distal leg paraesthesias. He reported subjective fever, cough, and myalgias which had developed 4 days earlier and resolved before presentation. His examination was notable for left mydriasis, mild ptosis, and limited depression and adduction, consistent with a partial left oculomotor palsy. Abduction was limited bilaterally consistent with bilateral abducens palsies. The second case was a 71-year-old woman with hypertension who presented with painless diplopia on waking 2 days before and could not abduct her right eye. Both patients had abnormal perineural or cranial nerve findings on magnetic resonance imaging nicely illustrated in the article. The authors concluded that in the setting of the COVID-19 pandemic, the occurrence of cranial neuropathies should prompt consideration of SARS-CoV-2 infection in patients with even mild symptoms and signs of COVID-19.

Michael S. Vaphiades

Colour vision in anterior ischaemic optic neuropathy

Pollock SC, Hubbe RE. Colour vision in anterior ischaemic optic neuropathy. *Am J Ophthalmol*. 2020;19:100823. doi:[10.1016/j.ajoc.2020.100823](https://doi.org/10.1016/j.ajoc.2020.100823)

The authors retrospectively reviewed the records of 45 patients with non-arteritic anterior ischaemic optic neuropathy (NAION) to analyse the relationship between colour vision and visual acuity using

a linear regression model. Colour vision tended to correlate with acuity; however, nine patients were identified in whom colour vision was relatively spared in comparison with acuity. Most of the affected eyes in this subgroup had a distinctive pattern of visual field loss consisting of a dense, steep-walled cecocentral defect centred below the horizontal meridian. The authors concluded that in patients with NAION, colour vision tends to correlate with visual acuity for acuities better than 20/70. Sparing of colour vision relative to acuity, a heretofore unreported finding in NAION, occurs in approximately 15% of cases. Sparing of colour vision reflects damage to foveal projections coupled with preservation of extrafoveal macular projections. In acute optic neuritis, the degree of dyschromatopsia tends to be out of proportion to the loss of acuity. Thus, the results this study may help to differentiate NAION from optic neuritis.

Michael S. Vaphiades

Optical coherence tomography for detection of asymptomatic optic nerve lesions in clinically isolated syndrome

Outterryck O, Lopes R, Drumez E, Labreuche J, Lannoy J, Hadhoum N, Boucher J, Vermersch P, Zedet M, Pruvo JP, Zéphir H, Leclerc X. Optical coherence tomography for detection of asymptomatic optic nerve lesions in clinically isolated syndrome. *Neurology*. 2020;95(6):e733–e744. doi:[10.1212/wnl.0000000000009832](https://doi.org/10.1212/wnl.0000000000009832)

The authors conducted a cross-sectional study of 130 patients who recently presented with a clinically isolated syndrome (CIS). All patients underwent optical coherence tomography and brain/optic nerve magnetic resonance imaging (MRI). Optic nerve involvement was defined clinically (episode of optic neuritis [ON] or not) and radiologically (optic nerve hypersignal on 3D double inversion recovery [3D-DIR]). They evaluated the sensitivity and specificity of previously published intereye retinal thickness difference (IETD) thresholds and report the observed optimal thresholds for identifying symptomatic optic nerve involvement but also for identifying asymptomatic optic nerve involvement (optic nerve hypersignal without ON history). Primary outcomes were ganglion

cell–inner plexiform layer (GC-IPL) and peripapillary retinal nerve fibre layer IETD. In the CIS with ON group, 3D-DIR showed a hypersignal in all 41 symptomatic optic nerves and in 11 asymptomatic optic nerves. In the CIS without ON group, 3D-DIR showed a unilateral optic nerve hypersignal in 22 patients and a bilateral optic nerve hypersignal in 7 patients. For the detection of symptomatic and asymptomatic optic nerve lesion, GC-IPL IETD had better performance. We found an optimal GC-IPL IETD threshold $\geq 2.83 \mu\text{m}$ (sensitivity 88.2, specificity 83.3%) for the detection of symptomatic lesions and an optimal GC-IPL IETD $\geq 1.42 \mu\text{m}$ (sensitivity 89.3%, specificity 72.6%) for the detection of asymptomatic lesions. The authors concluded that the detection of asymptomatic optic nerve lesions in CIS requires lower IETD thresholds than previously reported. GC-IPL IETD represents an alternative biomarker to MRI for the detection of asymptomatic optic nerve lesions.

Michael S. Vaphiades

Optic disc drusen associated anterior ischaemic optic neuropathy: prevalence of comorbidities and vascular risk factors

Rueløkke LL, Malmqvist L, Wegener M, Hamann S. Optic disc drusen associated anterior ischaemic optic neuropathy: Prevalence of comorbidities and vascular risk factors. *J Neuroophthalmol.* 2020;40(3):356–361.

The authors performed a case-controlled study of 13 patients with nonarteritic anterior ischaemic optic neuropathy (NA-AION) associated with optic disc drusen (ODD-AION) and 14 patients with NA-AION diagnosed in the period 2008–2017. All patients underwent an interview designed to evaluate history of vascular risk factors and comorbidities and re-examination including enhanced depth imaging optical coherence tomography to confirm the presence or absence of ODD. No significant differences were

found in demographic or clinical characteristics between the ODD-AION and the NA-AION group. Significantly more ODD-AION patients than NA-AION patients had no vascular risk factors (smoking, arterial hypertension, diabetes mellitus, and dyslipidemia) present and significantly fewer patients in the ODD-AION group were diagnosed with arterial hypertension or dyslipidemia than in the NA-AION group. This study supports the hypothesis that ODD is an independent risk factor for AION.

Michael S. Vaphiades

Young adults with anterior ischaemic optic neuropathy: A multicenter optic disc drusen study

Hamann S, Malmqvist L, Wegener M, et al. Young adults with anterior ischaemic optic neuropathy: A multicenter optic disc drusen study. *Am J Ophthalmol.* 2020;217:174–181. doi:10.1016/j.ajo.2020.03.052.

Optic disc drusen (ODD), present in 2% of the general population, have occasionally been reported in patients with non-arteritic anterior ischaemic optic neuropathy (NA-AION). The authors performed a retrospective, cross-sectional multicenter study of 65 patients (127 eyes) with NA-AION. Of the 74 eyes with NA-AION, 51% had ODD (ODD-AION), while 43% of (fellow) eyes without NA-AION had ODD. No significant difference was found between ODD-AION and NODD-AION eyes in terms of Snellen best corrected visual acuity or perimetric mean deviation. The authors concluded that the majority of young NA-AION patients had ODD supporting the hypothesis that ODD may be an independent risk factor for the development of NA-AION in younger patients.

Michael S. Vaphiades