Cone dystrophy phenotype associated with a frameshift mutation (M280fsX291) in the α-subunit of cone specific transducin (GNAT2)

M Michaelides, I A Aligianis, G E Holder, M P Simunovic, J D Mollon, E R Maher, D M Hunt, A T Moore

Aim: To describe the phenotype of a three generation consanguineous Pakistani family containing six individuals with autosomal recessive cone dystrophy caused by mutation in GNAT2.

Methods: Five of the six affected individuals underwent an ophthalmological examination, electrodiagnostic testing, fundus photography, autofluorescence imaging, and detailed psychophysical testing.

Results: All five examined patients had a history of nystagmus from infancy, photophobia, defective colour vision, and poor visual acuity. The nystagmus in three of the individuals had lessened with time. Fundus examination revealed an abnormal foveal appearance, without frank atrophy or pigmentation. Electroretinography (ERG) revealed absent ISCEV cone flicker ERGs with some preservation of responses to short wavelength stimulation. Rod ERGs showed no definite abnormality, but maximal (mixed rod-cone) response a-wave amplitudes were mildly subnormal. Rudimentary residual colour vision was detected in three individuals. There is clinical evidence of progressive visual acuity reduction in two older individuals.

Conclusion: Mutation in the α-subunit of cone specific transducin (GNAT2) is characterised by an infantile onset cone dystrophy. Some affected individuals may show deterioration of visual acuity with time.

The cone and cone-rod dystrophies form part of a clinically heterogeneous group of retinal dystrophies that are a major cause of childhood blindness. The major clinical features of cone dystrophies are reduced visual acuity, abnormal colour vision, photophobia, central scotomata, and often nystagmus. Cone dystrophies have been described with autosomal dominant, autosomal recessive, or X linked patterns of inheritance.4,5

Cone and cone-rod dystrophies are also phenotypically heterogeneous. Various subtypes have been identified on the basis of natural history and psychophysical and electrophysiological testing.6–11 These disorders may be stationary or progressive. The two well characterised stationary cone dystrophies are blue cone monochromatism, an X linked disorder in which there are only two functional classes of photoreceptor (rods and S-cones), and rod monochromatism.

Rod monochromatism or complete achromatopsia is a stationary cone dystrophy, with an incidence of approximately 1 in 30 000, in which there is an absence of functioning cone photoreceptors.6–7 Affected individuals usually present in infancy with nystagmus, poor visual acuity, photophobia, and complete colour blindness. Fundus examination is usually normal, but electroretinography reveals absent photopic (cone) responses and normal scotopic (rod) responses. Individuals with incomplete achromatopsia retain some colour vision.

Achromatopsia is recessively inherited and genetically heterogeneous. To date, three achromatopsia genes have been characterised, the first two described being CNGA3 and CNGB3, located at 2q11 and 8q21 respectively, and mutations in this gene have recently been described in patients with achromatopsia.13–16 However, a detailed description of the phenotype associated with GNAT2 inactivation has not been presented. In this report we have reviewed the phenotype of the large consanguineous Pakistani family in whom we identified a novel frameshift mutation in GNAT2 (c.842_843insTCAG; M280fsX291).17

Patients and Methods

Five affected members of a three generation, consanguineous Pakistani family with cone dystrophy were assessed after informed consent was obtained (Fig 1).

A full medical history was taken and an ophthalmological examination performed. Examined subjects also underwent colour fundus photography and fundus autofluorescence imaging using the confocal scanning laser ophthalmoscope (csSLO) (Zeiss Prototype; Carl Zeiss Inc, Oberkochen, Germany). Electrodiagnostic assessment included electrooculography (EOG), full field electroretinography (ERG) and pattern ERG (PERG), incorporating the protocols recommended by the International Society for Clinical Electrophysiology of Vision.17–19 S-cone ERGs were also recorded using a previously described protocol.20

Colour vision testing included the use of the Hardy, Rand, Rittler (HRR) plates (American Optical Company, New York, NY, USA), Sloan achromatopsia plates, enlarged Farnsworth D-15 (PV-16), the enlarged Mollon-Reffin (M-R) minimal test,21 and the Nagel anomaloscope. The PV-16, Sloan achromatopsia plates, and the M-R test were all performed under CIE Standard Illuminant C from a MacBeth Easel lamp.

The PV-16 and the enlarged M-R test were used in order to detect any residual colour discrimination that might be present in patients with low vision: the coloured discs of the PV-16 were 33 mm in diameter and those of the enlarged M-R test were 26 mm in diameter (corresponding to visual angles of 3.8 and 3.3 deg at a viewing distance of 500 mm). With the same purpose in mind, we also used a modification of the Cambridge colour test, a computerised test that allows the measurement of colour discrimination along different angles of 3.8 and 3.3 deg at a viewing distance of 500 mm).
directions in colour space. In the modified test, the stimulus array consisted of only four large discs, organised in a diamond pattern. Each disc subtended 4 degrees of visual angle at the viewing distance of 1 metre. On any presentation, one of the discs differed in chromaticity from the remaining three, and the patient’s task was to identify this disc by pressing one of four buttons within 4 seconds. To ensure that the discrimination was on the basis of chromaticity, the luminance of each disc was given a random value chosen from six levels between 4 cd/m² and 24 cd/m². To establish the patient’s threshold for a given direction in colour space, the chromatic difference between the target and distractor discs was adjusted by a double staircase procedure.

RESULTS
All five patients had a history of nystagmus from infancy, mild photophobia, defective colour vision, and poor visual acuity (6/60 to CF). They all described improved vision in mesopic conditions. Examination of the anterior segment was unremarkable, except for one individual (VI:3) who had a unilateral congenital cataract. Fundus examination revealed a mildly abnormal foveal appearance but without frank atrophy or pigmentation (Fig 2). Peripheral retinal examination was normal in all subjects. ERG showed absent cone responses to 30 Hz flicker, small responses to short wavelength stimulation, and normal rod specific ERGs, but mildly subnormal maximal response a-wave amplitudes (Fig 3). Autofluorescence imaging was normal in all individuals. Clinical findings are summarised in Table 1.

Two older individuals (V:2 and V:7) described a gradual deterioration of vision. Visual acuity in V:7 was 6/36 in both eyes when he first presented 30 years ago, while his current best corrected acuity is counting fingers. His brother V:2, also showed evidence of deterioration of visual acuity from 6/60 in both eyes documented 10 years ago, to counting fingers at present. Both subjects have more prominent horizontal pendular nystagmus than other affected family members.

All five patients had abnormal colour vision. At the Nagel anomaloscope all five patients exhibited a scotopic spectral sensitivity. Four patients displayed a scotopic pattern of arrangement on PV-16. One patient, V:7, unlike a typical patient with complete achromatopsia, produced only one major transposition on the PV-16. Rudimentary colour discrimination was also detected in three individuals on testing with the M-R minimal test, with variable ability to identify the most saturated chip along the deutan and/or tritan axes. Further evidence of residual colour vision was provided by the colour discrimination ellipses produced on computerised colour vision testing. The other two individuals, V:2 and V:4, displayed no residual colour vision and showed typical achromatopic matches on Sloan plates.

DISCUSSION
The phenotype in this family with a novel homozygous frameshift mutation in the cone a-transducin gene, GNAT2, is characterised by mild photophobia, nystagmus, abnormal colour vision, and poor visual acuity (6/36 to CF). Electroretinography using the ISCEV protocol revealed absent cone responses, with normal rod specific ERGs, but mild reduction in maximal response a-wave amplitudes. Small photopic responses to short wavelength stimulation were detectable. On detailed colour vision testing, residual colour discrimination was detected in three individuals.

This phenotype is similar therefore to the incomplete form of achromatopsia arising from certain mutations in CNGA3, the gene encoding the a-subunit of the cGMP gated cation channel in cones. Unlike complete achromatopsia, we have been able to record S-cone ERG responses in our patients and, in two older subjects, a worsening of visual acuity with age has been documented, although we have no definite evidence of progressive deterioration in retinal function. In achromatopsia we have found only one case report of progressive retinal degeneration in the form of mid-peripheral retinal pigment and concentric constriction of the peripheral visual fields. It was also reported that a few of the younger subjects in that achromatopsia series had small residual cone responses on ERG. Taken together, therefore, these findings may represent evidence that progression in retinal dysfunction may be present in at least some individuals with achromatopsia, but no natural history studies are available to corroborate this.
Retinal dysfunction in our family is predominantly confined to cone photoreceptors. In cone cells, light activated photopigment interacts with transducin, a three subunit guanine nucleotide binding protein, stimulating the exchange of bound GDP for GTP. The cone \( \alpha \)-transducin subunit (encoded by \textit{GNAT2}) is then released from its \( \beta \) and \( \gamma \) subunits and activates cGMP phosphodiesterase by removing the inhibitory \( \gamma \) subunits from the active site of this enzyme. cGMP phosphodiesterase lowers the concentration of cGMP in the photoreceptor which results in closure of cGMP gated cation channels and consequent hyperpolarisation of the photoreceptor. Thus, the finding of a germline \textit{GNAT2} mutation in a family with cone dystrophy is consistent with the known function of the \textit{GNAT2} product. Furthermore, mutations in human rod specific \( \alpha \)-transducin, which is 83\% homologous to cone \( \alpha \)-transducin, have been shown to be associated with the Nougaret form of congenital stationary night blindness. The frameshift mutation identified in our family results in a truncated protein that lacks 63 amino acids from the carboxy terminal. All the \textit{GNAT2} mutations identified by Kohl et al would also result in premature translation termination and in protein truncation at the carboxy terminal. This region contains important functional domains of \( \alpha \)-transducin which have been shown to interact with the rhodopsin and phosphodiesterase \( \gamma \)-subunits. However, if this mutation were to lead to a complete lack of \( \alpha \)-transducin function, it is difficult to explain the residual

### Table 1  Summary of clinical findings

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>VA</th>
<th>Refraction</th>
<th>Horizontal pendular nystagmus</th>
<th>ERG</th>
<th>Fundus</th>
<th>M-R colour vision test</th>
</tr>
</thead>
<tbody>
<tr>
<td>V:2</td>
<td>35</td>
<td>R CF</td>
<td>−3.5/+3.0×30</td>
<td>Prominent</td>
<td>Absent 30 Hz cone responses; Abnormal foveal appearance</td>
<td>P(no)D(no)T(no)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>L CF</td>
<td>−4.0/+3.0×160</td>
<td>Normal rod specific responses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V:4</td>
<td>41</td>
<td>R 6/60</td>
<td>−2.0/+2.0×110</td>
<td>Absent</td>
<td>Absent 30 Hz cone responses; Abnormal foveal appearance</td>
<td>P(no)D(no)T(no)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>L 6/60</td>
<td>−2.5/+1.5×70</td>
<td>Normal rod specific responses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V:7</td>
<td>44</td>
<td>R CF</td>
<td>−2.0/+2.0×135</td>
<td>Prominent</td>
<td>Absent 30 Hz cone responses; Abnormal foveal appearance</td>
<td>P(no)D(7)T(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>L CF</td>
<td>−1.5/+1.5×45</td>
<td>Normal rod specific responses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI:1</td>
<td>20</td>
<td>R 6/60</td>
<td>+1.5/+1.5×110</td>
<td>Absent</td>
<td>Absent 30 Hz cone responses; Abnormal foveal appearance</td>
<td>P(no)D(7)T(4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>L 6/60</td>
<td>+1.0/+2.0×80</td>
<td>Normal rod specific responses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI:3</td>
<td>19</td>
<td>R CF</td>
<td>Balance</td>
<td>Absent</td>
<td>Absent 30 Hz cone responses; Abnormal foveal appearance</td>
<td>P(no)D(6)T(5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>L 6/60</td>
<td>−2.0/+3.0×75</td>
<td>Normal rod specific responses</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ERG = counting fingers; M-R = Mollon-Reffin test. The letters give the axis P = protan, D = deutan, and T = tritan. The number in parentheses gives the least saturated chip that could be discriminated from the greys; VI:3 has a right sided congenital cataract.
colour vision along deutan and tritan axes in these individuals, if these are entirely cone mediated mechanisms. It is possible that the mutation results in a protein that, although severely reduced in efficacy, may still show some residual α-transducin function. Alternatively, there may be some redundancy within the cone phototransduction pathway that allows a level of continued function despite suboptimal or absent function of one of the components of the cascade.

The human cone transducin α-subunit (GNAT2) gene was previously characterised by Morris and Fong in 1993 and the evidence that this gene is expressed in all three cone types comes from the immunohistochemical demonstration that an antibody raised against cone α-transducin peptides cross-reacts with all three classes of cone photoreceptor in the human retina. This does not however definitively rule out the possibility that S-cones may express an alternative form of α-transducin since identical epitopes may be present on both forms. It may also be significant that Southern blot analysis of human genomic DNA indicated that there may be more than one cone α-transducin gene. Therefore, although there are no subsequent studies that provide any direct evidence for a S-cone specific cone α-transducin, it remains a possibility that GNAT2 is not expressed in S-cones, and that the residual S-cone function detected in our family arises from the use of this other distinct form of α-transducin. In this case therefore, the residual tritan colour discrimination may be accounted for by a comparison of quantum catches in the remaining functional S-cones and rod photoreceptors, in the manner proposed to underlie colour discrimination detected in blue cone monochromats.

A detailed description of the phenotype associated with mutation in the α-subunit of cone specific transducin has not been previously reported. It is characterised by a cone dystrophy with an infantile onset, a deteriorative of visual acuity with time in older individuals, and residual S-cone function.

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Authors’ affiliations

M Michaelides, D M Hunt, A T Moore, Institute of Ophthalmology, University College London, 11–43 Bath Street, London EC1V 9EB, UK
I A Aliganis, E R Maher, Section of Medical and Molecular Genetics, Department of Paediatrics and Child Health, University of Birmingham, Edgbaston, Birmingham B15 2TT, and West Midlands Regional Genetics Service, Birmingham Women’s Hospital, Birmingham B15 2TQ, UK
G E Holder, Moorfields Eye Hospital, City Road, London EC1V 2PD, UK
M Simunovic, J D Mallon, Department of Experimental Psychology, University of Cambridge, Downing Street, Cambridge CB2 3EB, UK

Correspondence to: Professor A T Moore, Institute of Ophthalmology, University College London, 11–43 Bath Street, London, EC1V 9EL, UK;
tony.moore@ucl.ac.uk

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Vision (627)

Notes
Heparin therapy in giant cell arteritis

Giant cell arteritis (GCA) is a systemic vasculitis that affects large and medium sized arteries. Visual loss is one of the most devastating complications of GCA and usually occurs from occlusion of the posterior ciliary arteries (PCA) leading to anterior ischaemic optic neuropathy (AION). Visual loss can also occur from occlusion of other arteries that supply the visual pathway, such as the central retinal and ophthalmic arteries.

Corticosteroid therapy, given orally or intravenously, is the standard treatment for GCA associated visual loss. The optimal route of administration and dosage to prevent further visual loss are not known; however, most clinicians advocate higher doses in patients who already have experienced visual loss. Treatment with corticosteroids usually results in stabilisation of visual loss and some patients may have some degree of visual recovery.

The reported use of adjunctive agents under these circumstances has been limited. We report a patient who had progressive visual loss while on high dose intravenous corticosteroids and who markedly improved after treatment with heparin.

Case report

An 85 year old man presented to his optometrist for a routine eye examination. His visual acuity was 20/40 both eyes and his optic discs were normal. Three weeks later (day 1), he lost vision in his right eye. His visual acuity was now 20/100 right eye and 20/40 left eye. On visual field testing with

Figure 1. Photomicrograph of temporal artery biopsy histological section shows a marked proliferation of smooth muscle cells that can be seen as dark reddish/brown concentric rings in the thickened medial and intimal layers (stain, actin which is selective for smooth muscle cells, original magnification, ×250).

Figure 2. Serial automated static perimetry. (A) Day 5: mean deviation (MD) = −19.63 dB left eye, no light perception (NLP) right eye. (B) Day 6: MD = −17.99 dB LE, hand motion (HM) right eye. (C) Day 7: MD = −12.30 dB left eye, MD = −24.60 dB right eye. (D) Day 8: MD = −5.58 dB left eye, MD = −15.66 dB right eye. (E) Day 9: MD = −17.63 dB left eye, MD = −19.66 dB right eye. (F) Week 4: MD = −12.80 dB left eye, MD = −26.87 dB right eye.
On day 4, his visual acuity was light perception (LP) and he was transferred to our institution.

On our initial examination (day 4), his visual acuity was LP right eye and 20/30 left eye. He had a right relative afferent pupillary defect (RAPD), pale optic disc oedema on the right, and a normal appearing optic disc on the left. The Westergren erythrocyte sedimentation rate (ESR) was 74 mm in the first hour. The IVMP was continued as before, and a temporal artery biopsy (TAB) was performed which was positive for GCA (fig 1).

On day 5, his visual acuity decreased to no light perception (NLP) right eye and 20/80 left eye. His right pupil was amaurotic and his left pupil reacted sluggishly. Static perimetry now showed an inferior altitudinal defect in the left eye (fig 2A). The right optic disc appearance was unchanged but the superior portion of the left optic disc was now pale and oedematous. Posterior ciliary artery (PCA) blood flow could not be detected in either eye with orbital colour Doppler imaging (CDI) (table 1). Heparin (5000 units intravenous bolus) was started, and titrated to maintain the partial thromboplastin time (PTT) within a therapeutic range (46–70 seconds).

On day 6, his PTT was 74 seconds and his visual acuity improved to hand motion (HM) right eye and 20/70 left eye. His right pupil reacted sluggishly and the left pupil reacted more briskly with a right RAPD. Static perimetry was essentially unchanged (fig 2B) and there was no appreciable change in the optic disc appearance. The ocular blood flow characteristics with orbital CDI (fig 3A) were unchanged (table 1).

On day 7, while continuing IVMP and heparin, his visual acuity improved to counting fingers (CF) at 1 foot right eye and 20/50 left eye. The pupillary examination was unchanged. Static perimetry now showed an inferior altitudinal defect in the left eye with diffuse loss and the right eye. The pupillary examination was unchanged. Static perimetry was improved (fig 2C). Posterior ciliary artery blood flow was now detectable with orbital CDI (table 1). Warfarin (2.5 mg by mouth four times daily) was added and titrated to a therapeutic level. By day 8, his visual acuity had improved to 20/400 right eye and 20/50 left eye. Static perimetry was further improved (fig 2D). The ocular blood flow characteristics on orbital CDI likewise improved (table 1). The pulsatility index of the central retinal artery (CRA) was markedly decreased (fig 4). Oral corticosteroid therapy (prednisone 100 mg by mouth daily) and warfarin at the 4 week follow up visit while taking 100 mg of prednisone daily and warfarin, his visual acuity deteriorated to 20/400 right eye and 20/80 left eye. Static perimetry was unchanged. The ocular blood flow characteristics on orbital CDI (fig 3C) remained unchanged (table 1). At the 4 week follow up visit while taking 100 mg of prednisone daily and warfarin, his visual acuity deteriorated to 20/400 right eye and 20/80 left eye. Static perimetry was unchanged. The ocular blood flow characteristics on orbital CDI (fig 3B) remained stable (table 1). The patient was discharged from the hospital with oral corticosteroid therapy (prednisone 100 mg by mouth daily) and warfarin.

At the 1 week follow up visit (day 15), his visual acuity improved to 20/80 right eye and 20/40 left eye. Static perimetry was unchanged. The ocular blood flow characteristics on orbital CDI (fig 3C) remained unchanged (table 1). The ocular blood flow characteristics on orbital CDI (fig 3B) remained stable (table 1). The patient was discharged from the hospital with oral corticosteroid therapy (prednisone 100 mg by mouth daily) and warfarin. At 1 week follow up visit (day 15), his visual acuity improved to 20/80 right eye and 20/40 left eye. Static perimetry was unchanged. The ocular blood flow characteristics on orbital CDI (fig 3C) remained unchanged (table 1). The patient was discharged from the hospital with oral corticosteroid therapy (prednisone 100 mg by mouth daily) and warfarin.
Review of five large series of visual outcome in GCA treated with either oral or intravenous corticosteroid therapy

<table>
<thead>
<tr>
<th>Reference</th>
<th>Year</th>
<th>Total number of patients with GCA</th>
<th>Number of patients with visual loss</th>
<th>Number of patients (%) with visual stabilisation</th>
<th>Number of patients (%) with visual recovery</th>
<th>Number of patients (%) with progression of visual loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chan et al.</td>
<td>2001</td>
<td>73</td>
<td>73</td>
<td>43 (59)</td>
<td>21 (29)</td>
<td>9 (12)</td>
</tr>
<tr>
<td>Liu et al.</td>
<td>2000</td>
<td>147</td>
<td>23</td>
<td>17 (74)</td>
<td>5 (22)</td>
<td>1 (4)</td>
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<tr>
<td>Villar-Garcia et al.</td>
<td>1998</td>
<td>239</td>
<td>34</td>
<td>22 (65)</td>
<td>8 (23)</td>
<td>4 (12)</td>
</tr>
<tr>
<td>Liu et al.</td>
<td>1993</td>
<td>45</td>
<td>41</td>
<td>20 (49)</td>
<td>14 (34)</td>
<td>7 (17)</td>
</tr>
<tr>
<td>Aiello et al.</td>
<td>1992</td>
<td>245</td>
<td>34</td>
<td>24 (70)</td>
<td>5 (15)</td>
<td>5 (15)</td>
</tr>
</tbody>
</table>

Characteristics on orbital CDI remained unchanged. At the 3 month follow up visit while still on the same medications, his visual acuity deteriorated to LP right eye and improved to 20/60 left eye. Static perimetry of the left eye was unchanged and the ocular blood flow characteristics on orbital CDI again remained stable bilaterally. His prednisone dosage was slowly tapered and the warfarin was discontinued.

Comment

Once visual loss occurs in GCA, the goals of treatment with corticosteroid therapy are to prevent further progression and to reverse the visual loss if possible. Table 2 reviews the treatment results of GCA with either oral or intravenous corticosteroid therapy in five large series of patients. After initiation of corticosteroid therapy, most patients experienced visual stabilisation, a small number had improvement of vision, and even fewer had progression of visual loss.

The reason for progression of visual loss despite treatment with corticosteroid therapy is unknown. One possible reason is that the dose of corticosteroids was inadequate. Both the dose and route of administration of corticosteroids varied in the studies in table 2. Therefore, it is difficult to assess whether the treatment dose was adequate or if intravenous administration is superior to oral administration.

Most clinicians support the use of high dose intravenous corticosteroids for patients who have experienced visual loss from GCA. However, progression of visual loss has been described despite high dose IVMP. 1

Another possible reason for the progression of visual loss despite treatment is that corticosteroid therapy alone is an inadequate treatment for some patients. A review of our patient’s TAB showed near total luminal stenosis by intimal hyperplasia with proliferation of actin stained smooth muscle cells in the arterial media and intimal layers (fig 1). Complete arterial occlusion can occur with progression of the hyperplastic process or may be the result of superimposed arterial thrombosis. Perhaps with advanced luminal stenosis, corticosteroids are not as effective as they are early in the inflammatory cascade and may not be able to prevent thrombosis.

We found one report of the use of heparin for visual loss in GCA.7 In a review of 174 patients with GCA, Liu et al reported the use of heparin in most patients with permanent visual loss and some patients with threatening symptoms.7 However, the specific results of this treatment were not reported. The use of heparin has also been described for manifestations of GCA other than visual loss. Staal described a 64 year old man with TAB proved GCA and clinical signs of an evolving vertebrobasilar stroke and ischaemic cerebellar lesion on MRI while on oral corticosteroid therapy. His symptoms improved following treatment with high dose intravenous dexamethasone and heparin. It has been postulated that systemic anticoagulation may be beneficial during the initial phase of steroid treatment because of recent evidence that anti-cardiolipin antibodies are present in a higher frequency in patients with GCA.7

Normally, heparin occurs complexed to histamine as a macromolecule in mast cells and its physiological role is unknown. Heparin has an immediate anticoagulatoin effect after intravenous administration. The coagulation process generates thrombin by two interrelated pathways, the extrinsic and intrinsic. Both pathways involve a cascade of enzymatic reactions that ultimately form thrombin. Thrombin catalyses the conversion of fibrinogen to fibrin that forms the matrix of a thrombus. Thrombin also activates clotting factor XIII that is necessary for stabilising the cross links of the fibrin molecules. If thrombin production or production is impeded then coagulation is inhibited. Antithrombin III is an α-globulin that inhibits thrombin. Heparin indirectly binds to antithrombin III and forms a complex that more rapidly inhibits thrombin formation, thereby preventing coagulation and clot formation.

Heparin has also been shown to have other biochemical activities such as regulation of lipid metabolism, control of blood fluidity at the endothelial surface, control of cell attachment to various proteins in the extracellular matrix, binding with acidic and basic fibroblast growth factors, binding to interleukin 3 and granulocyte-macrophage colony stimulating factor. Heparin is a potent inhibitor of serotonin induced pulmonary artery smooth muscle cell hypertrophy. The mechanism by which heparin led to improvement of vision in our patient is not known and perhaps its therapeutic effect was unrelated to anticoagulation. None the less, serial orbital CDI showed improvement in ocular blood flow (table 1; fig 3A-C). Colour Doppler imaging is an ultrasonic imaging modality that combines B-mode ultrasonography with Doppler ultrasonography. When applied to the orbit, this imaging modality allows for the assessment of ocular blood flow and has been described in detail elsewhere.17 18 Blood flow towards the transducer is displayed as red and represents arterial flow, whereas blood flow away from the transducer is displayed as blue and represents venous flow. Pulsed Doppler with spectral analysis can be used in conjunction with the CDI to accurately quantify the systolic and diastolic flow characteristics. The pulsatility index can be calculated and represents an assessment of vascular resistance to blood flow. A high pulsatility index indicates a high resistance and therefore reduced blood flow.

Initially, the systolic and diastolic pressures of the CRA were well below normal and the pulsatility index was markedly increased. The flow parameters of the CRA were undetectable. After heparinisation (day 5), flow was restored to the PCA circulation (day 7, table 1). The pulsatility index of the CRA also decreased (days 6–8, fig 4). The decrease in pulsatility index represents a decrease in blood flow resistance. The decrease in pulsatility index and restoration of blood flow to the CRA circulation both correspond to an improvement in visual acuity and visual field. The sequence of rapid improvement of orbital CDI haemodynamics, visual acuity, and visual field strongly suggest that the administration of heparin was responsible. Since this occurred rapidly, some of the biochemical activities of heparin, such as inhibition of smooth muscle cell hypertrophy and the others that act on a more chronic time line could not have caused improvement. A more likely candidate might be the control of blood fluidity at the endothelial surface.

In summary, the use of corticosteroid therapy alone for the treatment of GCA may have limited therapeutic success. The pathogenic mechanism of luminal stenosis in GCA is undergoing revision,11 and the emerging model offers possibilities for novel therapeutic intervention. Our patient had a remarkable improvement in visual acuity within 24 hours after starting heparin. Over the ensuing 2 days his visual field and ocular blood flow improved. The improvement with the addition of heparin may have been coincidental, and his vision may have recovered with IVMP alone. However, the continued decline in visual function, despite 3 days of IVMP, and his dramatic improvement after starting heparin, strongly suggests that heparin had a pivotal role in his recovery.

At the 3 month follow up visit, his vision in the right eye deteriorated to LP, even though...
his ocular blood flow characteristics were stable. We are uncertain about the reason for his decline in visual function, since at the time of the decline, he was maintained on oral corticosteroid and his serial ESR values were normal. None the less, we suggest that in patients who experience a progression of visual loss from GCA, despite IVMP therapy, may benefit acutely from the addition of heparin therapy.

L M Buono
Neuro-Ophthalmology Service, Duke University Eye Center, Erwin Road, Box 3802, Durham, NC 27710, USA

R Foroozan
The Cullen Eye Institute, Baylor College of Medicine, Department of Ophthalmology, 6555 Fannin Street, NC-205, Houston, TX 77030, USA

M de Virgiliis
Department of Ophthalmology, Hospital Pedro Lagleyze, Buenos Aires, Argentina

P J Savino
Neuro-Ophthalmology Service, Wills Eye Hospital, Thomas Jefferson Medical College, 840 Walnut Street, Philadelphia, PA 19107, USA

Correspondence to: Dr Lawrence M Buono, Duke University Eye Center, Erwin Road, Box 3802, Durham, NC 27710, USA; buono501@med.duke.edu


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References


Retinal migraine: caught in the act

A 22 year old male dancer presented via his optometrist following an episode of transient visual loss in his left eye. He described a slow blurring and darkening of the vision of the left eye with a similarly gradual return to normal, the whole episode lasting 10 minutes. He described similar episodes every 2–3 months for the previous 3 years with no associated migrainous aura or headache, and exercise was not a trigger. Figure 1 shows images taken before, during, and 10 minutes after his presenting episode (see figure legend for description).

Visual acuity was no perception of light when tested during the episode and had recovered to 6/6 in the affected left eye when seen 2 hours later at our ophthalmic emergency department. Aside from congenital proptosis there were no other ocular or systemic abnormalities. On subsequent review his visual acuity had returned to 6/6 bilaterally and his fundus appearance remains normal. There was no visual field abnormality (Goldmann 12e, 14e) and haematological (including thrombophilia screen), carotid, and cardiac investigations were normal.

Comment

Retinal migraine (otherwise known as ophthalmic migraines, anterior visual pathway migraines, or ocular migraines) causes monocular visual loss for 10–20 minutes which can be associated with diffuse or unilateral headache. People experiencing ocular migraines often have a history of one of the more conventional forms of migraine, and exercise may precipitate the attacks. Vasospasm of the retinal circulation or ophthalmic artery is thought to be the cause of the amaurosis of ocular migraine. Ischaemic optic neuropathy and permanent arcuate scotomas may occur after ocular migraine and retinal vascular occlusions have been reported in conjunction with cerebral and ocular migraine.

Retinal vasospasm may be associated with underlying systemic diseases such as SLE and antiphospholipid syndrome. In older patients it may be associated with giant cell arteritis, polyarteritis nodosa, and cosinophilic vasculitis. Other associated haematological abnormalities include low protein C and S levels and positive antinuclear antibodies. A relative afferent pupillary defect can be demonstrated during episodes. Retinal arterioles have been reported to constrict, and the fovea may become more distinct with surrounding macular retinal pallor. The optic discs may be pale early and hyperaemic later. Early isolated constriction of veins has been reported, which may be segmental, as well as simultaneous constriction of arterioles and veins. Later engorgement of the retinal veins has been observed some hours after an attack. Nerve fibre bundle defects can sometimes be a late finding.

Our case demonstrates photographically the arterial vasoconstriction of retinal migraine (fig 1), which occurred in the absence of a precipitating cause such as...
exercise and in the absence of a migrainous aura or headache.

Doppler studies have revealed cessation of retinal arterial flow during an exercise induced retinal migraine episode. A 48 year old cluster headache sufferer who underwent fluorescein angiography during an ocular migraine attack demonstrated narrowing of the retinal veins and delayed retinal artery filling during the episode with normal choroidal filling. 10 Most previously published photographs have shown venous, retinal, and disc changes late in the attack, perhaps reflecting that arterial vasoconstriction occurs early during attacks and is not often photographed. 3, 9, 11 Alternatively, there may be a spectrum of severity of retinal migraine manifestations, which in severe cases may result in a transient pale macular area with manifestations, which in severe cases may result in a transient pale macular area with extreme pallor.

Figure 2 Panoramic FA of the right eye on January 1999 (A) and February 2003 (B).

When considered necessary, effective treatments include propranolol, 3 verapamil, 4 and nifedipine. 5 Prophylactic aspirin or nifedipine may be tried to prevent exercise induced attacks, and inhaled amyl nitrate can be used early in an attack to try to induce resolution. 1

Acknowledgement

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E Doyle, B J Vote, A G Casswell
Sussex Eye Hospital, Eastern Road, Brighton BN2 5BF, UK

Correspondence to: Mr Eddie Doyle, Sussex Eye Hospital, Eastern Road, Brighton BN2 5BF, UK; EdRachie@btinternet.com

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References


Long term follow up in a case of successfully treated idiopathic retinal vasculitis, aneurysms, and neuroretinitis (IRVAN)

The idiopathic retinal vasculitis, aneurysm, and neuroretinitis (IRVAN) syndrome is a rare clinical entity characterised by peripheral retinal vascular occlusion, retinal vasculitis, and multiple posterior retinal arterial aneurysms. 2, 3 In most reported cases, visual acuity was aggravated.4, 5 We report a case of successfully treated IRVAN syndrome in which good long term visual acuity has been maintained.

Case report

A 36 year old woman visited the Kansai Medical University Hospital on January 1999, complaining of flies flying in her right eye for the past year. She also had visual disturbance and metamorphopsia for 2 months in her right eye. Her best corrected visual acuity was 20/40 in the right eye and 20/16 in the left eye. Inflammatory cells were noted in both the anterior chamber and vitreous cavity. There was mild ruberosis iridis in the left eye. In the right eye, there was a fibrovascular membrane in the epipapillary area accompanying tractional retinal detachment, thick hard exudates on nasal side of the fovea, and vitreous haemorrhage (Fig 1A). Her optic disc was mildly hyperaemic, and multiple aneurysms surrounded by perivascular exudation were observed at the posterior retinal artery in the left eye (Fig 1B). Extensive arterial and venous vascular occlusion and adjacent anomalous arteriovenous anastomosis were observed at the peripheral retina in both eyes (Fig 2).

Systemic examination and laboratory findings did not suggest systemic abnormality, and the family history was not contributory. Oral prednisolone was initiated at 50 mg/day and decreased gradually. In an attempt to prevent peripheral retinal neovascularisation, panretinal photocoagulation (PRP) was car-

Figure 1 Vitreous haemorrhage, neovascularisation of the optic disc, and hard exudates were observed in the right eye (A), and hard exudates surrounding the optic disc and aneurysms shown by fundus fluorescein angiogram (FA) was observed in the left (B) on January 1999. The right eye (C), and aneurysms shown by FA in the left (D) were improved by February 2003.

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ried out to treat the peripheral retinal non-perfusion area. Since vitreous haemorrhage in the right eye did not improve, right eye vitrectomy was performed on March 1999, and tractional retinal detachment and vitreous haemorrhage subsequently improved. The aneurysms disappeared by 5 months and the hard exudates by 12 months. Her corrected visual acuity improved to 20/20 in the right eye and 20/16 in the left eye by February 2003 (Fig 1C and D).

Comment
The disappearance of retinal aneurysm in IRVAN has been reported in two cases. In both of these cases, scattered retinal photocoagulation was performed on the peripheral retinal non-perfusion area. In one case in which scattered retinal photocoagulation was not performed, it has been reported that some aneurysms enlarged, others became small, and new aneurysms appeared. In our case, all retinal arterial aneurysms vanished after PRP (Fig 1B and D). These results strongly suggest that PRP applied to the non-perfusion area is useful and should be performed during the early phase. On the other hand, it has been reported that retinal lesions are unresponsive to oral steroids in most cases of IRVAN. We think vitrectomy must precede PRP applied to the non-perfusion area. Since vitreous haemorrhage and retinal non-perfusion area are related to retinopathy in patients with type 1 diabetes. In addition, it was reported that HLA-DR was expressed in proliferative retinopathy. Little is known, however, about the relation between retinopathy with type 2 diabetes and the HLA antigen. Furthermore, most previous studies have not taken into consideration the background of glycaemic control or the duration of the diabetes. A group of younger onset type 2 diabetes patients with PDR, and a group who had no signs of retinopathy despite a long duration of diabetes were compared. Younger patients were studied to reduce the influence of adult diseases such as hyperlipidaemia and hypertension. In addition, clinical background factors were considered when studying the frequency of HLA types.

METHODS
Following the informed consent of each of the subjects, blood samples were collected. The study was approved by the human studies review board of Tokyo Women’s Medical University and was performed in accordance with the Helsinki Declaration of 1975 and its 1983 revision. The diagnosis of type 2 diabetes was made based on 1985 World Health Organization criteria. We excluded subjects who were GAD antibody positive. The patients had been diagnosed as having type 2 diabetes aged under 30 years.

Table 1: Clinical profile of the control group, non-DR group, and PDR group

<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>Non-DR group</th>
<th>PDR group</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>50</td>
<td>45</td>
<td>44</td>
<td>NS</td>
</tr>
<tr>
<td>Age (years)†</td>
<td>27.4</td>
<td>27.8</td>
<td>29.2</td>
<td>(4.1)</td>
</tr>
<tr>
<td>Male/female</td>
<td>25/25</td>
<td>20/25</td>
<td>20/24</td>
<td>–</td>
</tr>
<tr>
<td>Age at the diagnosis of diabetic retinopathy (years)</td>
<td>–</td>
<td>–</td>
<td>21.6</td>
<td>(4.1)</td>
</tr>
<tr>
<td>Age at the time of vitreous surgery (years)</td>
<td>–</td>
<td>–</td>
<td>28.8</td>
<td>(4.4)</td>
</tr>
<tr>
<td>Hba1C (%)</td>
<td>–</td>
<td>7.7</td>
<td>7.9</td>
<td>NS*</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>0 (0.0%)</td>
<td>3 (6.7%)</td>
<td>4 (8.3%)</td>
<td>NS*</td>
</tr>
<tr>
<td>Renal disease (%)</td>
<td>0 (0.0%)</td>
<td>13.3%</td>
<td>15 (34.1%)</td>
<td>0.02**</td>
</tr>
<tr>
<td>Neurophysiological neuropathy (%)</td>
<td>0 (0.0%)</td>
<td>9 (20.0%)</td>
<td>18 (40.9%)</td>
<td>0.02**</td>
</tr>
<tr>
<td>Positive family history (%)</td>
<td>0 (0.0%)</td>
<td>15 (33.3%)</td>
<td>19 (43.1%)</td>
<td>NS**</td>
</tr>
</tbody>
</table>

|                           | 1 Kincaid J, Schatz H. Bilateral retinal arteritis with multiple aneurysmal dilatations. Retina 1983;3:171 |
|                           | 4 Sashihara H, Hayashi H, Oshima K. Regression of retinal arterial aneurysms in a case of idiopathic retinal vasculitis, aneurysms, and neuroretinitis. Retina 1999;19:250 |

HLA typing is not predictive of proliferative diabetic retinopathy in patients with younger onset type 2 diabetes mellitus

Chronic hyperglycaemia and the duration of diabetes are the most important factors in retinopathy. However, retinopathy progresses in some patients despite good glycaemia control. Also, poor glycaemia control does not always lead to retinopathy in younger onset patients, while still others develop severe retinopathy that is resistant to retinal photocoagulation.

These facts suggest that the risk factors for diabetes and retinopathy are not necessarily the same, and that the development of severe retinopathy may be influenced by genetic factors. Human leucocyte antigen (HLA) status has a significant role in immune responses and immunological tolerance and is a factor in the onset of type 2 diabetes. DR4, DR8, DR9, and several antigens of the DQ region are related to retinopathy in patients with type 1 diabetes. In addition, it was reported that HLA-DR was expressed in proliferative retinopathy. Little is known, however, about the relation between retinopathy with type 2 diabetes and the HLA antigen. Further, most previous studies have not taken into consideration the background of glycaemic control or the duration of the diabetes. A group of younger onset type 2 diabetes patients with PDR, and a group who had no signs of retinopathy despite a long duration of diabetes were compared. Younger patients were studied to reduce the influence of adult diseases such as hyperlipidaemia and hypertension. In addition, clinical background factors were considered when studying the frequency of HLA types.

RESULTS

The frequencies of HLA-A, B, and Cw antigens in the control group, the non-DR group, and the PDR group are shown in table 2, and those of DR, and DQ antigens in table 3, respectively.

There was no significant difference among the three groups in HLA-A, B, and DQ antigens. The non-DR group showed higher frequencies of HLA Cw4 (χ² = 4.027, p = 0.044).

Table 1: Clinical profile of the control group, non-DR group, and PDR group

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</tr>
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<td>29.2</td>
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<td>25/25</td>
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<td>20/24</td>
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<tr>
<td>Age at the diagnosis of diabetic retinopathy (years)</td>
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<td>–</td>
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</tr>
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<td>Age at the time of vitreous surgery (years)</td>
<td>–</td>
<td>–</td>
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<td>–</td>
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<td>15 (33.3%)</td>
<td>19 (43.1%)</td>
</tr>
</tbody>
</table>

Number of patients or mean (SD). NS = not significant.

The age was compared between each group.

Comparisons between the non-DR group and the PDR group by unpaired t test. Comparisons between the non-DR group and the PDR group χ² test of independence or Fisher’s exact probability test.

†Age at the time of this study.

*Average value over 10 years.
Table 2  HLA-A, B, and C antigen frequencies (%) in each group

<table>
<thead>
<tr>
<th>Control group</th>
<th>Non-DR group</th>
<th>PDR group</th>
<th>Control v non-DR</th>
<th>Control v PDR</th>
<th>non-DR v PDR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x^2</td>
<td>p Value</td>
<td>Odds ratios</td>
<td>x^2</td>
<td>p Value</td>
</tr>
<tr>
<td>A1</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.000</td>
<td>NS</td>
</tr>
<tr>
<td>A2</td>
<td>19 (38.0)</td>
<td>18 (40.0)</td>
<td>15 (31.3)</td>
<td>0.040</td>
<td>NS</td>
</tr>
<tr>
<td>A11</td>
<td>10 (20.0)</td>
<td>8 (16.0)</td>
<td>20 (42.2)</td>
<td>0.076</td>
<td>NS</td>
</tr>
<tr>
<td>A24 (9)</td>
<td>29 (58.0)</td>
<td>28 (56.0)</td>
<td>29 (58.0)</td>
<td>0.176</td>
<td>NS</td>
</tr>
<tr>
<td>A26 (10)</td>
<td>11 (22.0)</td>
<td>10 (20.0)</td>
<td>15 (30.5)</td>
<td>0.001</td>
<td>NS</td>
</tr>
<tr>
<td>A28</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.000</td>
<td>NS</td>
</tr>
<tr>
<td>A30 (19)</td>
<td>1 (2.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.000</td>
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<tr>
<td>A31 (19)</td>
<td>10 (20.0)</td>
<td>10 (20.0)</td>
<td>10 (20.0)</td>
<td>0.000</td>
<td>NS</td>
</tr>
<tr>
<td>A33 (19)</td>
<td>8 (16.0)</td>
<td>7 (14.0)</td>
<td>7 (14.0)</td>
<td>0.010</td>
<td>NS</td>
</tr>
<tr>
<td>A37</td>
<td>1 (2.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.000</td>
<td>NS</td>
</tr>
<tr>
<td>B7</td>
<td>5 (10.0)</td>
<td>4 (8.0)</td>
<td>4 (8.0)</td>
<td>0.034</td>
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</tr>
<tr>
<td>B13</td>
<td>1 (2.0)</td>
<td>1 (2.2)</td>
<td>0 (0.0)</td>
<td>0.006</td>
<td>NS</td>
</tr>
<tr>
<td>B17</td>
<td>1 (2.0)</td>
<td>2 (4.4)</td>
<td>1 (2.3)</td>
<td>0.043</td>
<td>NS</td>
</tr>
<tr>
<td>B27</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.000</td>
<td>NS</td>
</tr>
<tr>
<td>B35</td>
<td>8 (16.0)</td>
<td>7 (14.0)</td>
<td>8 (16.0)</td>
<td>0.010</td>
<td>NS</td>
</tr>
<tr>
<td>B37</td>
<td>1 (2.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.000</td>
<td>NS</td>
</tr>
<tr>
<td>B46</td>
<td>5 (10.0)</td>
<td>5 (10.0)</td>
<td>5 (10.0)</td>
<td>0.031</td>
<td>NS</td>
</tr>
<tr>
<td>B48</td>
<td>3 (6.0)</td>
<td>2 (4.4)</td>
<td>4 (8.8)</td>
<td>0.011</td>
<td>NS</td>
</tr>
<tr>
<td>B51 (5)</td>
<td>9 (18.0)</td>
<td>8 (16.0)</td>
<td>6 (13.6)</td>
<td>0.001</td>
<td>NS</td>
</tr>
<tr>
<td>B52 (5)</td>
<td>11 (22.0)</td>
<td>10 (20.0)</td>
<td>13 (26.5)</td>
<td>0.001</td>
<td>NS</td>
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<tr>
<td>B54 (22)</td>
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<td>8 (16.0)</td>
<td>6 (13.6)</td>
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<td>NS</td>
</tr>
<tr>
<td>B56 (22)</td>
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<td>2 (4.4)</td>
<td>4 (8.8)</td>
<td>0.012</td>
<td>NS</td>
</tr>
<tr>
<td>B59</td>
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<td>2 (4.4)</td>
<td>6 (13.6)</td>
<td>0.012</td>
<td>NS</td>
</tr>
<tr>
<td>B60 (40)</td>
<td>5 (10.0)</td>
<td>3 (6.0)</td>
<td>6 (13.6)</td>
<td>0.031</td>
<td>NS</td>
</tr>
<tr>
<td>B61 (40)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.000</td>
<td>NS</td>
</tr>
<tr>
<td>B62 (15)</td>
<td>8 (16.0)</td>
<td>7 (14.0)</td>
<td>7 (14.0)</td>
<td>0.053</td>
<td>NS</td>
</tr>
<tr>
<td>B67</td>
<td>1 (2.0)</td>
<td>1 (2.2)</td>
<td>0 (0.0)</td>
<td>0.006</td>
<td>NS</td>
</tr>
<tr>
<td>B70</td>
<td>1 (2.0)</td>
<td>1 (2.2)</td>
<td>0 (0.0)</td>
<td>0.006</td>
<td>NS</td>
</tr>
<tr>
<td>B75</td>
<td>1 (2.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.010</td>
<td>NS</td>
</tr>
<tr>
<td>Cw1</td>
<td>16 (32.0)</td>
<td>12 (24.0)</td>
<td>12 (24.0)</td>
<td>0.324</td>
<td>NS</td>
</tr>
<tr>
<td>Cw3</td>
<td>23 (46.0)</td>
<td>20 (40.0)</td>
<td>22 (44.4)</td>
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<td>NS</td>
</tr>
<tr>
<td>Cw4</td>
<td>7 (14.0)</td>
<td>14 (28.0)</td>
<td>9 (18.0)</td>
<td>0.027</td>
<td>NS</td>
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<tr>
<td>Cw5</td>
<td>1 (2.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0.000</td>
<td>NS</td>
</tr>
<tr>
<td>Cw6</td>
<td>1 (2.0)</td>
<td>1 (2.2)</td>
<td>4 (8.8)</td>
<td>0.027</td>
<td>NS</td>
</tr>
<tr>
<td>Cw7</td>
<td>11 (22.0)</td>
<td>7 (14.0)</td>
<td>7 (14.0)</td>
<td>0.045</td>
<td>NS</td>
</tr>
<tr>
<td>Cw8</td>
<td>6 (12.0)</td>
<td>2 (4.4)</td>
<td>1 (2.3)</td>
<td>0.006</td>
<td>NS</td>
</tr>
<tr>
<td>Cw9</td>
<td>7 (14.0)</td>
<td>2 (4.4)</td>
<td>2 (4.5)</td>
<td>0.006</td>
<td>NS</td>
</tr>
</tbody>
</table>

Numbers in parentheses are percentages. NS = not significant. All p values were not significant other than Cw4 with p = 0.045 in the control v non DR test.
While there was no significant difference between non-DR group and PDR group in any of the HLA antigens. The PDR group showed higher frequencies of HLA DR4 than the control group ($\chi^2 = 4.398$, p = 0.036) than the control group (tables 2 and 3).

These findings are consistent with our present results. Additionally an increase in HLA-DR4, which is in linkage disequilibrium with the DQB1*0302 allele has previously been reported in patients with type 2 diabetes. This increase was mainly reported to be restricted to patients with relative insulin deficiency or antibodies to islet cells or to glutamic acid decarboxylase.

DR4 was detected in 59.1% of the PDR group, but this was not significantly different from the frequency in the non-DR group (51.1%). DR4 may, therefore, be related to the onset of type 2 diabetes, but not to the development of retinopathy. The HLA-DR4 levels reflected the antibody levels in the pancreatic Langerhans island but not the parameter of diabetic change in the retina.

In summary, our research suggests that HLA antigen investigations may be useful for predicting the prognosis of younger onset type 2 diabetes, but not for retinopathy in these patients. Finally, we must precisely define the alleles or combination of alleles which cause increased susceptibility to PDR.

Acknowledgements

The authors gratefully acknowledge the assistance of Ms Jayne Simons for critically reviewing the manuscript.

References


Effect of docosahexaenoic acid supplementation on retinal function in a patient with autosomal dominant Stargardt-like retinal dystrophy

The gene, ELOVL4, is mutated in Stargardt-like macular dystrophy, a juvenile onset disorder. ELOVL4 is homologous to a fatty acid elongase presumably involved in the biosynthesis of docosahexaenoic acid, DHA. 
Humans can synthesize DHA from precursors in small amounts, which may not be sufficient for normal retinal function if intake is minimal.

Case report
A 15 year old girl with Stargardt-like macular dystrophy and a mutation in ELOVL4 was given a dietary supplement of DHA on two occasions. A 7 day dietary history, prior to starting DHA supplementation, estimated her daily intake of DHA as 20 mg, in a diet of 1602 kcal. Beginning in April 2001, she was supplemented with 20 mg/kg body weight per day of DHA in capsules (Martek Biosciences, Columbia, MD, USA). Her functional response was determined by a VF-14 questionnaire, visual acuity testing, multifocal electrotoretinography (mfERG), and plasma phospholipid analysis. At baseline, fundus photography showed minimal macular changes (fig 1); however, the mfERG revealed significant macular dysfunction. A full field ERG performed in March 2000 revealed a reduction of approximately 30–40% in rod and cone responses, with the predominant effect on the b-wave amplitude in comparison with normative data (DTL electrode, dilated pupils, recorded according to ISCEV standards). No anomaly of latency was observed in either the mfERG or full field ERG recordings.

Peripheral blood samples were taken in a non-fasting state at the beginning of the study. Her baseline plasma DHA level was at the low end of the median for a North American diet, 24 μg/ml; whereas her omega-6 arachidonic acid was 76 μg/ml. Her plasma DHA level increased after 2 months of supplementation to 86 μg/ml (fig 2). She reported progressive subjective improvement in vision on the VF-14 questionnaire. Analysis of the mfERG tracings revealed that an improvement had occurred in amplitudes from the foveal and parafoveal regions of the macula (fig 2). For this study, we accepted the group average response of rings 1–2 (0–5°), and rings 3–5 (5–25°), derived from a 63 hexagon stimulus (Veris, San Mateo, CA, USA), as simulating the foveal and parafoveal responses respectively. Visual acuity improved from 20/200 to 20/100 only in her left eye with the DHA supplementation.

Unfortunately, she lost interest in the study, became non-compliant despite our encouragement, and was lost to follow up from August 2001 to the end of March 2002. She returned after perceiving that her vision had declined since halting the DHA supplementation. Repeat plasma DHA testing confirmed that her plasma DHA had dropped to levels approaching those from the beginning of the study (35 μg/ml, fig 2). Supplementation was once again initiated. After 4 months (July 2002), she showed the same improvements in visual function both subjectively (VF-14 score) and objectively (mfERG amplitudes, fig 2), coincident with an increase in plasma DHA.

The patient’s visual acuity again improved only in the left eye from 20/200 to 20/100. Another full field ERG was conducted in July 2002 to compare with the diagnostic series from March 2000. The amplitudes of the photopic b-wave and the scotopic b-wave both improved by 30%, averaging both eyes. The scotopic mixed rod-cone response showed increased amplitude of the a-wave by 85%, and b-wave by 46%, when responses from both eyes were averaged. These results could not be explained by intervisit variability and suggest the effect of DHA supplementation occurs beyond the macula, over the entire retina.

Comment
The patient’s young age, low dietary intake of DHA, and a mutation in ELOVL4 may have particularly predisposed her to an early macular degeneration. A longer experience with DHA supplementation in young patients with Stargardt-like macular dystrophy could determine if DHA supplementation can alter the natural history.

Acknowledgements
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I M MacDonald, M Hébert, R J Yau, S Flynn, J Jumpen, M Suh, M T Clandinin
Departments of Ophthalmology and Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada; and the Department of Ophthalmology (MH), Medical Research Centre, CHUQ, Laval University, Quebec City, Quebec, Canada
Correspondence to: Dr Ian M MacDonald, Department of Ophthalmology, Royal Alexandra Hospital, 10240 Kingsway Ave., Edmonton, Alberta, Canada T5H 3V9; macdonal@ualberta.ca
Grant support: MSI Foundation, Alberta, Canada; University of Alberta Hospitals Foundation, Olive Young Fund; Royal Alexandra Hospital Foundation; Canadian Institutes for Health Research (MH Fellowship support).

Ethics: The health research ethics board of the University of Alberta approved this study and written consent was obtained before participation in the study.

Figure 1 Fundus photograph of 15 year old patient at baseline examination.

Figure 2 Effect of DHA on retinal function in patient with ELOVL4 mutation.

Severe retinopathy of prematurity (ROP) in a premature baby treated with sildenafil acetate (Viagra) for pulmonary hypertension

Sildenafil is used as a selective pulmonary vasodilator in children with primary pulmonary hypertension and severe lung fibrosis. It improves gas exchange, increasing life expectancy and exercise tolerance. Recent animal models of neonatal pulmonary hypertension have also shown that sildenafil reduces vascular resistance. This has encouraged its use in units treating premature infants. We report a case of severe retinopathy of prematurity in a preterm infant who was treated with intravenous sildenafil for severe respiratory failure.

Case report
The patient was born at 26 weeks gestation weighing 525 g. He was ventilated from birth for respiratory insufficiency, secondary to respiratory distress syndrome. He required high flow oxygen ventilation and received surfactant at delivery and 16 hours later. His oxygen requirements then stabilised at 30–50%.

At 29 weeks his oxygen requirements increased to 100% due to coagulase negative Staphylococcus aureus and candida sepsis. He was treated with amphotericin and 5-fluorotyrosine. However, he was only able to maintain oxygen saturations of 70–80% while receiving positive pressure ventilation on 80–90% oxy-
Sildenafil relaxes arteriolar smooth muscle in the presence of nitric oxide by inhibiting phosphodiesterase type 5 (PDE5). PDE5 is found in high concentrations in the smooth muscle of the corpus cavernosum, and in lower concentrations in other tissues such as vascular smooth muscle. NO may control retinal blood flow. Measurement of ocular blood flow changes following sildenafil have shown conflicting results, with some groups showing a significant increase and others showing no increase in choroidal blood flow.\(^5\)

In ROP, the initial constriction of retinal vessels by the high levels of oxygen induces a neovascular drive through the release of growth factors such as vascular endothelial growth factor (VEGF). Subsequent retinal hypoperfusion has been linked to progression of other neovascular disease such as diabetic retinopathy,\(^7\) by the local release of growth factors and free radical production. In addition, NO and cGMP accumulation caused by PDE5 inhibition has been proposed to exert a proliferative effect on retinal post-capillary venules.

Although sildenafil seems to have a unique place in the treatment of preterm infants in respiratory failure, this case may link its use to the development of aggressive ROP. We have observed a recent increase in treatable ROP in our unit, coinciding with the use of sildenafil. Further work on the retinal effects of sildenafil may be of use in determining whether it truly is a risk factor in the pathogenesis of ROP.

References

Indocyanine green localisation in surgically excised choroidal neovascular membrane in age related macular degeneration

Clinical indocyanine green (ICG) angiography has gained an established role in the diagnosis of choroidal neovascularisation (CNV) in age related macular degeneration (AMD).\(^1\)\(^4\) It is potentially able to localise CNV with greater accuracy compared with fluorescein angiography because it fluoresces in the infrared range, allowing imaging of choroidal pathology through blood and pigment.\(^1\) Additionally ICG angiography may better define CNV because of its high protein binding affinity in serum,\(^3\) resulting in reduced leak from the CNV. This allows ICG angiography to clearly delineate the feeding vascular supply to the CNV allowing direct ablative thermal laser to precisely target this supply.\(^5\)

Treatments for CNV, including thermal laser, photodynamic therapy, and macula translocation are all reliant on the ability of the clinician to diagnose accurately the location and nature of CNV. Few clinicopathological data exist to correlate the ICG angiographic appearance of CNV with its histology. The presence of CNV was shown pathologically in an eye with a plaque like hyperfluorescence on ICG angiography shown years previously.\(^4\) Lafaut reported the pathology of surgically removed recurrent CNV in two eyes that were preoperatively imaged with ICG angiography.\(^5\) The hyperfluorescence of drusen on ICG angiography in the monkey model has been correlated with ICG dye that has been found histologically on infrared fluorescence microscopy.\(^9\)

In this case report we hope to correlate ICG angiographic findings in a patient with exudative AMD with the histological localisation of ICG to the surgically excised CNV. This will verify that ICG angiographic findings are an accurate representation of the location and nature of the CNV.

Figure 1 Clinical angiography. (A) Preoperative fluorescein angiography shows that the lesion is well defined and extends into the fovea. (B) Preoperative mid-phase ICG angiogram shows the feeding vascular network that is originating from a perifoveal site. (C) Postoperative fluorescein angiography shows the removal of the CNV. (D) Postoperative ICG angiogram confirms the removal of the CNV.
Case report
A 71 year old patient with classic subfoveal CNV was recruited into this study to histologically localise ICG dye to excised CNV in AMD. The study was granted institutional research approval by the Sydney Eye Hospital Ethics Committee.

Angiographic evaluation
The patient underwent preoperative imaging with fluorescein and ICG angiography to define the nature and location of the CNV. The angiographic studies were performed on the Heidelberg Scanning Laser Ophthalmoscope (Heidelberg, Germany). Diagnostic studies were performed using 5 ml of 10% fluorescein dye and 25 mg of ICG dye (Pulsion Medical Suppliers, München, Germany).

Follow up angiographic studies were performed one month following surgical removal of the new vessel using standardised methods as outlined above. This was done to confirm the removal of the new vessel.

Surgical procedure
The patient underwent surgical removal of the CNV under assisted peribulbar regional anaesthesia 72 hours later. A three port trans pars plana vitrectomy and removal of the posterior vitreous hyaloid was performed. A small retinotomy adjacent to the CNV was made through which a localised retina detachment was created. The CNV was extracted with subretinal forceps through the retinotomy. Haemostasis was achieved by raising the height of the infusion bottle, increasing intraocular pressure. A fluid-gas exchange was carried out after checking the retina periphery for tears.

Histologic localisation of ICG dye
Fifteen minutes before excising the CNV, 50 mg of ICG dye was administered as an intravenous bolus to allow the ICG to bind to the CNV. The excised specimen was taken immediately to be fixed in 20% dimethyl sulphoxide (Sigma, NSW, Australia) plus 80% adult fixative containing 2% paraformaldehyde in 0.1 M phosphate buffered saline (PBS) (pH 7.4) for 20 minutes.

The tissue was embedded in a small tissue embedding mold with Tissue-Tek OCT 4583 compound embedding medium (Bayer, NSW, Australia) and then rapidly frozen in liquid nitrogen. The frozen tissue block was mounted onto Cryostat Microtome (Leitz, Kryostat 1720, Australia) and 20 µm sections were cut. Sections were collected with gelatin-Alum coated slides and air dried. Sections were then examined for ICG infrared fluorescence or stained with cresyl violet for histologic examination.

Infrared fluorescence microscopy
The technique of infrared fluorescence microscopy to identify ICG fluorescence has been previously described. An 810 nm diode laser (Iris Technologies) was used with an excitation filter to stimulate the surgical specimen. A Nikon Eclipse fluorescence microscope with a custom 860 nm barrier filter (Chroma Technologies, Vermont, USA) was used to detect the emitted ICG fluorescence. Paired bright field images with the corresponding infrared fluorescence image were used to orient the infrared fluorescence image and recorded digitally.

For histological studies, tissue sections were stained with cresyl violet for 30 seconds, rinsed and dehydrated in graded ethanol, cleared in xylene, and mounted in DePeX (BDH, Melbourne, Australia). The sections were examined and photographed under light microscopy.

Angiographic appearances
Fluorescein angiography shows a well defined hyperfluorescent lesion which extends under the fovea consistent with presumed CNV (Fig 1A). ICG angiography shows a hyperfluorescent vascular lesion in the same location (Fig 1B).

Postoperative fluorescein and ICG angiography (Fig 1C and D) reveal the absence of the hyperfluorescence confirming that the subfoveal lesion has been excised.

Histologic localisation of ICG
Figure 2A shows the light microscopic image of the surgical specimen stained with cresyl violet. The CNV has a fibrovascular structure. There are associated patchy islands of intact retinal pigment epithelium (RPE) monolayer which are indicated by the arrowheads. Figure 2B is a bright field microscopic image of the surgical specimen. Figure 2C is the corresponding fluorescence microscopic

image which shows ICG localised to the excised CNV. Note that the small islands of intact RPE cells indicated by arrows are intensely fluorescent.

Comment
This report provides a direct clinicopathological correlation of CNV defined on ICG angiography, with ICG localised to the excised surgical membrane by infrared fluorescence microscopy. This is unique in that the ICG itself is detected within the excised CNV. This report confirms that hyperfluorescence defined on fluorescein and ICG angiography is consistent with CNV. The hyperfluorescent lesion shown preoperatively is absent following surgical removal of the specimen.

Indocyanine green was histologically localised to the fibrovascular structure of the CNV. It is proposed that ICG enters rapidly into the neovascular complex through its feeding vascular network. The ICG within the feeding vascular network is able to be imaged on the early phase clinical ICG angiography. Subsequently, it is likely that the ICG extravasates through the leaky vessels to bind to the supportive stromal tissues. In this later phase, clinical ICG angiography does not show the feeding vasculature.

Histologically, the CNV was associated with an incomplete layer of RPE cells which were removed with the CNV. This suggests that the CNV in the case studied appeared to be sub-RPE in location. This is consistent with the histopathology of specimens from the Submacular Surgery Trial which would indicate that the CNV in AMD tends to grow under the retina.

This report provides information regarding the interaction of ICG with RPE. The intact RPE that were removed with the CNV were intensely fluorescent on infrared fluorescence microscopy. The fluorescence of the RPE was more intense than the fibrovascular tissue. This suggests that that RPE cells accumulate ICG. This finding corroborates the previous histologic localisation studies in the monkey and human model which showed ICG localisation to the RPE.

The frozen section technique was employed because it allows the water soluble ICG to remain within its in vivo location. Conventional histological processing would cause the ICG to leak through the tissue planes misrepresenting its true position. Previous histological localisation studies in the rat model have been performed using frozen section techniques. Preservation of tissue architecture in this study was limited by crush artefact by the subretinal forceps and subsequent extraction from the subretinal space. Additionally, the frozen section processing technique results in tissue expansion and disruption.

This clinicopathological correlation provides the clinician with greater confidence in diagnosing CNV based on ICG angiography.

Acknowledgement
The study was granted institutional research approval by the Sydney Eye Hospital Ethics Committee.

A A Chang, M Zhu, F A Billson
Department of Clinical Ophthalmology & Save Sight Institute, University of Sydney, Sydney, Australia

A A Chang
Sydney Eye Hospital, Sydney, Australia

A A Chang, N L Kumar, P E Beaumont
Sydney Retina Clinic, Sydney, Australia
Correspondence to: Dr Andrew Chang, Department of Clinical Ophthalmology & SavE Sight Institute, The University of Sydney- Sydney Eye Hospital, GPO Box 4337, Sydney, NSW 2001, Australia; achang@sydneyretina.com.au

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References


Correction of pseudophakic anisometropia in a patient with pseudoxefolation using an implantable contact lens

Pseudophakic anisometropia may cause significant patient dissatisfaction with marked visual problems. Correction methods include contact lenses, intraocular lens (IOL) exchange, piggybacking a supplementary IOL, and corneal refractive surgery.

The Staar surgical implantable contact lens (ICL) was first used to correct myopia and hyperopia in phakic patients. It is now being used to correct pseudophakic anisometroopia.

The following case describes the successful management of pseudophakic anisometropia using an ICL in a patient with high myopia and pseudoxefolation.

Case report

An 80 year old woman was referred to us for correction of pseudophakic anisometropia. She had bilateral pseudoxefolation and was highly myopic, her original refraction being −14.00 DS right eye, −13.50/S+1.75×20 left eye.

In 1989 she underwent left cataract extraction with posterior chamber IOL, keeping her highly myopic (−13.00/−2.00×105 left eye).

She subsequently developed cataract in her right eye so underwent uncomplicated right phacoemulsification with posterior chamber lens implantation, leaving her +1.00/−1.00×45 in her right eye.

Because of her marked anisometropia she experienced visual difficulties unresolved with spectacles or contact lenses, so she requested permanent correction of this.

Refraction, keratomy, corneal thickness (using pachymetry), axial length (using ultrasound), anterior chamber depth, and horizontal white to white distance (using Orbscan), were measured and sent to Staar Surgical who calculated the ICL power.

A −19.0 Dioptre Staar Collamer ICL was inserted via an injector into the left sulcus, anterior to her posterior chamber IOL, through a corneal tunnel. Two iridectomies were made. Antibiotic and steroid drops were used postoperatively.

Postoperative refraction was right eye +1.00/−1.00×45 6/12, left eye +3.00/−1.00×105 6/12+. Her symptoms resolved and she was extremely pleased.

Comment

Insertion of a Staar Collamer ICL seems to be an effective alternative method for correcting anisometropia in pseudophakic patients.

All surgical options have their risks and complications.

Corneal refractive surgery is irreversible and complications include flap related problems, corneal scarring, variable refractive outcome, and regression. 

Supplementary anterior chamber lenses for moderate to high ametropia are devised for phakic eyes. No implants are devised for pseudophakic anisometropia.

Insertion of a Staar Collamer ICL seems to be a relatively safe method for correcting pseudophakic anisometropia.

It is better to prevent postoperative refractive surprises, but if they do occur, insertion of an ICL can be used to correct pseudophakic anisometropia, especially in patients with pseudoxefolation.

N N Ashraf, B V Kumar, A Das, A P Moriarty
Department of Ophthalmology, Stepping Hill Hospital, Stockport, UK.

Correspondence to: Nina Ashraf, Manchester Royal Eye Hospital, Oxford Road, Manchester M13 9WH, UK; ninaashraf@hotmail.com

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References


Dopamine is an indicator but not an independent risk factor for grade 3 retinopathy of prematurity in extreme low birthweight infants

Retinopathy of prematurity (ROP) is a multifactorial disease with numerous risk factors. Indicators besides birth weight or gestational age might be used to further discriminate the relative risk of developing ROP associated with a given gestational age or birth weight. Dopamine might be such an indicator since Mizoguchi et al reported on the association of dopamine and the risk of developing ROP in survivors (n = 41) with a birth weight below 1000 g and suggested that this association might be causal.

To document whether dopamine is an indicator or an independent risk factor for developing ROP, a retrospective chart review in extreme low birthweight (ELBW)—that is, below 1000 g—infants in a single neonatal intensive care unit during a 2 year period (2000–2001) was performed. Neonatal characteristics collected were birth weight, gestational age, and dopamine, but no dopamine was found to be an independent risk factor for developing ROP.

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In the first week of life was entered in a multiple regression model with either maximal oxygenation index or maximal MAP or CRIB score, dopamine was no longer an independent risk factor to develop threshold ROP.

Comment
In line with Mizoguchi, an association of dopamine with an increased risk to develop ROP was found. In addition, dopamine was no longer an independent risk factor of developing grade 3 ROP after correction for either CRIB score or oxygen index in a multiple regression model.

Although it is hypothesised that a synergistic effect of hypoxia and dopamine might induce retinal vascular constriction in early neonatal life, it is more likely that this risk factor is merely an indicator of cardiovascular instability and not an aetiologic factor involved in the pathogenesis of ROP.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Dopamine use in survivors (n = 69) and its association with the incidence and severity of retinopathy in extremely low birthweight infants (p value calculated using $\chi^2$ test)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dopamine</td>
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<tr>
<td>Number</td>
<td>47</td>
</tr>
<tr>
<td>No ROP</td>
<td>29%</td>
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<tr>
<td>Any ROP</td>
<td>70%</td>
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<tr>
<td>Grade 3 ROP</td>
<td>44%</td>
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<tr>
<td>Threshold ROP</td>
<td>30%</td>
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</tbody>
</table>

Consent of the blind and visually impaired: a time to change practice
It is a general legal and ethical principle that valid consent must be obtained before starting treatment or physical investigation of a patient. The validity of consent does not depend on the form in which it is given (verbal or written), rather it depends on it being given voluntarily by an appropriately informed person who has the capacity to consent to the intervention in question. Written consent merely serves the evidence of consent. There is no English statute setting out the general principles of consent, rather it is set by precedent or case law (“common law”). Hence, in visually impaired (VIPs), instead of written consent should we not have moved to a better alternative—recorded audio consent (RAC)—legally equivalent as a record of consent but practically superior as a method? There are many good reasons why we should.

Firstly, health professionals are required to take all reasonable steps to facilitate communication with the patient, using interpreters or communication aids as appropriate. The Department of Health has issued guidance on communication with patients who have sensory disabilities. For those who cannot see, RAC would be more in line with these guidelines and recommendations than written consent.

Secondly, the problems with vision are frequently compounded by poor hand-eye coordination and manual dexterity especially as most VIPs (2.4 million in England and Wales) are over 65 years old. RAC would overcome the problems in these circumstances. Further, as many procedures VIPs have are not eye related and the consenting physician non-eye trained (therefore not used to dealing with VIPs and their difficulties), non-opthalmic units would also benefit from this technique.

Thirdly, we speak faster than we write and in all event the whole process needs to be undertaken verbally in the first instance. RAC would be a time saving exercise.

Fourthly, ever advancing current technologies allow for large volumes of audio recording in a more space efficient manner than cumbersome written consent. These devices (digital recorders, dictaphones, and others) are now available on the mass market at relatively low cost or already present within the health services.

Fifthly, section 21 of the Disability Discrimination Act states that service providers are obliged to take reasonable steps to change practices, policies, or procedures which make it impossible or unreasonably difficult for a disabled person to use a service. All people steps will have to be taken to remove difficulties altogether. RAC works strongly in conjunction with this act.

Finally, a practitioner trying to convince an opposing party that a blind person had been able to read the form they signed, thus providing evidence of informed consent,
would certainly find it more difficult to prove than if the whole consent process had been recorded with RAC.

RAC would thus benefit patients and practitioners alike, facilitating consent and making it a more robust process in the United Kingdom and other countries alike.

G M Saleh
Essex County Hospital, Lexden Road, Colchester CO3 3NB, UK, drgmsaleh@yahoo.co.uk
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Magnetic resonance angiography source images in carotid cavernous fistulas

Several investigations, including magnetic resonance imaging (MRI), computed tomography (CT), and orbital ultrasound are used to non-invasively screen for carotid cavernous fistula (CCF), with variable results. Examination of magnetic resonance angiography (MRA) source images, in addition to conventional MRA reconstructions, is extremely helpful in CCF detection, with 83% sensitivity and 100% specificity, far superior to standard MRI. Examination of MRI source images is particularly useful in the absence of anterior drainage and superior orbital vein enlargement. Gadolinium-enhanced MRA source images do not increase diagnostic accuracy. In our patient, superior orbital vein enlargement and slightly increased flow voids in the region of the CCF were present on MRI, but MRA source images provided the most striking and direct evidence of CCF. Similar to other non-invasive techniques, MRA source images cannot delineate CCF arterial feeders or detect cortical venous drainage. Hence, conventional angiography remains necessary for definitive management. However, non-invasive techniques such as MRA source images have an important role in pre-angiographic diagnostic decisions.

Discussion

Carotid cavernous fistulas are abnormal communications between the carotid artery and the cavernous sinus, either directly or via intradural branches of the internal or external carotid arteries. Direct fistulas are high flow, frequently follow trauma, and tend to have a dramatic clinical presentation. In contrast, indirect fistulas are low flow, often spontaneous, and may have a subtle clinical presentation. Symptoms and signs common to both types of fistulas include proptosis, chemosis, diplopia, visual loss, pulse-synchronous tinnitus, orbital bruit, elevated intraocular pressure, dilated episcleral veins, and retinal venous congestion. The pattern of venous drainage, either anterior into the ophthalmic veins or posterior into the petrosal sinuses, often dictates the clinical findings and radiographic appearance. Anterior drainage typically leads to the most dramatic ocular findings and enlargement of the superior orbital vein, the latter often detectable with CT or MRI. However, superior orbital vein enlargement is not specific to CCF. Additional radiographic findings with variable prevalence include lateral bulging of the cavernous sinus wall and enlargement of extraocular muscles on CT. Abnormal carotid and abnormal cavernous sinus flow voids on MRI. Conventional MRA reconstructed images rarely provide additional useful information. Direct visualisation of flow related hyperintensity on the source images of three dimensional time-of-flight MRA can be extremely helpful in CCF detection, with 83% sensitivity and 100% specificity, far superior to standard MRI. Examination of MRI source images is particularly useful in the absence of anterior drainage and superior orbital vein enlargement. Gadolinium-enhanced MRA source images do not increase diagnostic accuracy. In our patient, superior orbital vein enlargement and slightly increased flow voids in the region of the CCF were present on MRI, but MRA source images provided the most striking and direct evidence of CCF. Similar to other non-invasive techniques, MRA source images cannot delineate CCF arterial feeders or detect cortical venous drainage. Hence, conventional angiography remains necessary for definitive management. However, non-invasive techniques such as MRA source images have an important role in pre-angiographic diagnostic decisions.

Acknowledgements

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J C Bucker
Departments of Neurology and Ophthalmology, Case Western Reserve School of Medicine, Cleveland, OH, USA
V Biousse
Departments of Ophthalmology and Neurology, Emory University School of Medicine, Atlanta, GA, USA
N J Newman
Departments of Ophthalmology, Neurology, and Neurological Surgery, Emory University School of Medicine, Atlanta, GA, USA
Correspondence to: Dr Newman, Neuro-ophthalmology Unit, Emory Eye Center, 1365-B Clifton Rd, NE Atlanta, GA 30322, USA, ophninn@emory.edu
Accepted for publication 1 June 2003

References
Response to allegations and some considerations on interferon treatment in Behçet’s disease

Kotter et al refer to some problems, such as fabrication of authorship, possibly data, and ethical transgressions, in our article published in the Lancet. However, they do so without knowing the current facts about an ongoing process. They cite accusations that rely on an unfinalised investigation from the year 2000. As we are now in 2003, I do feel that I have to present updated correct information.

Before I do that, however, I would like to note that there is still scientific evidence against fabrication of the results; the reproducibility by other groups, as I mentioned at the beginning. It is well shown in the literature that our results are being increasingly reproduced, and I am happy to see that. In our clinic, we have been using interferon in Behçet’s disease since the early 1990s and we are among the first groups to use it in this disease. We published our preliminary results previously. The main problem in Behçet’s disease is to prevent serious complications such as vascular thrombotic attacks, ocular involvement, and their recurrences. Conventional drugs and corticosteroids have very little, if any, effect on the course of such complications. The first 2 years of the disease is the most critical period and the disease generally runs a more severe course in patients in whom the disease is diagnosed at an age less than 30. I believe that as interferon use is increased, ocular complications of Behçet’s disease will be minimised as well as extraocular manifestations. I suggest that the earlier we begin interferon, the better.

ADDENDUM

In the action of annulment, until a final decision was reached, the highest administrative court, the State Council of Turkey (Danistay) had issued a stay order against any administrative act due to the claimed ethical transgression, in favour of me, stating that the administrative act would result in damages which are difficult or impossible to compensate, and at the same time the act is clearly unlawful... On 5 November 2003, the 12th Chamber of the State Council of Turkey arranged a trial (file no 2002/883), this time for a final decision. At the end of the session, the prosecutor of the State Council of Turkey read his opinion which argued with the unlawfulness of the act and suggested cancellation of any administrative act, after which the court gave its final decision.

Haluk Demirıoglu
Hacettepe University Medical School, Department of Internal Medicine, Ankara, Turkey
Correspondence to: H. Demirıoglu, Selimiye Cad, 1 Sok 5/21, Yakarı Aryançı, Ankara, Turkey; halukdemiriglu@yahoo.com and halukd@hacettepe.edu.tr

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Are we overlooking the side effects of the drugs in our zeal to conquer ARMD?

First of all let me congratulate the authors for their work on exudative ARMD. But there are still some issues which need to be brought into account:

1. Some published studies show that even 4.0 mg of intravitreal triamcinolone has significant side effects in terms of increased IOP and more so for eyes which needed the second dose of the triamcinolone, with a few of them even needing a filtration surgery. In this particular study however 25mg of Triamcinolone has been used which may cause even more increased elevation of IOP. This issue is an important one as many of our ARMD patients have co-existing chronic open angle glaucoma with a compromised blood supply of the optic nerve head. With the intravitreal steroids induced rise in IOP, we may tilt the balance on the wrong side thereby taking their peripheral vision along with the central loss due to the ARMD.2,3

2. The effect of intravitreal steroids in the progression of cataract is not emphasized much in various studies. If earlier cataract surgery in treated ARMD patients is required, this has theoretical implications in terms of ultraviolet light exposure – one of the environmental factors implicated in ARMD. If there is no long term benefit for preventing the progression of ARMD with the steroids then why should we increase the chances of cataract in these patients thereby rendering their retina more vulnerable to damage caused by the UV radiation?

3. Various in vitro studies suggest that down-regulation of inflammatory markers and changes in the endothelial cell permeability are probably the modes of action of triamcinolone in exudative ARMD, but all these actions are probably reduced when the steroids are in high concentration in the vitreous. To maintain high concentrations triamcinolone should be injected repeatedly and probably that is the reason the improvement fades with time in many patients. Moreover none of the studies published so far have been long enough to actually give a fair idea about the long term

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outcome. The longest duration for which the follow up has been done is 18 months.  

We need data from multicenter, placebo-controlled trials on a much larger population with long-term follow-up to establish the efficacy of the drug and assess possible side effects and complications. Until then we should probably reserve this therapy for those cases where there is recurrence after laser treatment.  

U Bhatt  
Wrexham Maelor Hospital, Crespennwyd Road, Wrexham LL13 7TX, UK; bhattudaay@yahoo.com

References

BOOK REVIEWS

Genetics for Ophthalmologists: the Molecular Genetic Basis of Ophthalmic Disorders

This is Remedia’s latest addition to its Genetics for……. series. Ophthalmologists can now join cardiologists, dermatologists, haematologists, oncologists, orthopaedic surgeons, chest physicians and rheumatologists in having their very own “genetics bible.” The fact is that no self respecting ophthalmologist, paediatrician, or clinical geneticist should be without a copy.  

Imagine, you are in the clinic and the patient sitting in front of you has what looks like a macular dystrophy. The age of the patient and the family history helps to some extent with the diagnosis but you can’t quite remember what associations you should be looking for or which genes may be involved. Should you be taking blood for DNA analysis or is genetic testing still part of the distant future in the NHS? You find a reason why your patient needs to leave the room—refraction, visual fields, colour vision anything will do—you reach for your handy “bible” and flick straight to page 88. There you find 20 useful pages on macular dystrophies with fabulous illustrations to impress your patient. No need to go home feeling inadequate and wishing you had listened more in your genetics lectures (if you were lucky enough to have them). You can counsel your patient appropriately and feel great! Thanks to Graeme Black.  

Genetics is on the television, on the internet, and in the outpatient clinic. Patients come armed with questions and are often very well informed about their condition. As clinicians we have to keep abreast of the rapid changes that occur in genetics. Over the past 20 years there has been a revolution in molecular medicine. Advances in laboratory techniques have enabled diagnoses and even predictions of disease inheritance that were previously only possible by given as risk estimates. How and where does the ophthalmologist find this information without spending hours on the internet or pouring through journals? Black has provided the answer in his book Genetics for Ophthalmologists.  

In the introduction there is a list of useful websites that provide up to date information on inherited eye disease. The preface covers common but controversial issues that arise in counselling, such as whether it is ethical to predict risk to children before the age of consent. Then you come to the meat of the book … Black has provided the reader with a comprehensive coverage of inherited eye diseases starting at the cornea and working back towards the optic nerve.  

The format of the book is easy to follow with lots of colour photographs and useful summaries of the clinical and diagnostic criteria for each condition. Information about inheritance patterns, penetrance, the effect of mutations and whether genetic screening is current possible will be invaluable to those involved in counselling families. There are also a very helpful glossary at the back for those less used to genetic terminology.  

This is the type of book that should be in every outpatient clinic consulting room with a spare copy in the departmental library. Genetics for Ophthalmologists will appeal to paediatricians, clinical geneticists, and all those with an interest in inherited eye disease. While, perhaps, the reader will no doubt keep the author busy, the reader can sit back in the confidence that an extensive literature review has already been done allowing more time to be spent with the patient discussing the impact of this wealth of information.  

Amanda Churchill

Oculoplastic surgery: review 1

This is a wonderfully detailed book by an experienced oculoplastic and orbital surgeon. It is remarkable, as most mortal oculoplastic surgeons would have struggled over 10 years to write such a book, but Brian Leatherbarrow has succeeded in concentrating his encyclopaedic knowledge into a comprehensive tome in only two years. The result is a first class book, consisting of 26 chapters, 364 pages, and over 1200 original colour drawings, clinical photographs, and black and white diagrams.  

The book is logically organised with an introductory chapter, which outlines basic principles and distils these into simple oculoplastic aphorisms. This leads nicely into 10 chapters on common oculoplastic conditions: the eyelid malpositions (ptosis, entropion, and ectropion), facial palsy, and periorbital tumour management/construction. The book then gradually develops the link between oculoplastics and orbital surgery with five chapters on trauma: of the eyelid, simple orbital fractures, zygomatic fractures, and more complex orbital trauma. Even if you are not going to perform this type of surgery, it is worthwhile having an idea of what is involved.  

There are then three very sound chapters on ophthalmic surgery: assessment and working towards the options for surgical approaches to the orbit and the management of thyroid eye disease. Again there is this effortless, but essential, link between orbit and eyelid, with thyroid eyelid retraction correctly being covered here.  

The lacrimal surgery chapter is comprehensive and is well illustrated. Interestingly, blepharoplasty and eyebrow ptosis are placed quite late in the book and initially seemed a little unusual. In fact, it is sensible, as both of these require the surgeon to have a deeper knowledge of brow and orbit anatomy, not least to manage potential complications. The illustrations of brow anatomy and the various approaches to brow ptosis are fabulous, and include up to date endoscopic techniques.  

The chapters on enucleation, exenteration, and socket work are very sound, as is the final chapter on autogenous grafts, which should be read frequently.  

Who is this book aimed at? Perhaps not the beginning, though if I were starting out now I would find this book, particularly with its fresh colour drawings, extremely helpful and inspirational. It is definitely a must as a reference for difficult cases and is also very practical to dip into, particularly before doing an operation that perhaps the surgeon has not performed for a few weeks or months.  

Every ophthalmologist interested in oculoplastic surgery should seriously consider obtaining a copy of this book for it contains so many tips in it, each time I open it I learn something new, even something as simple as using a piece of Steri-drape to mark the template for a skin graft.  

The pictures and text are precise, clear, and uncluttered. I could hardly find any errors, perhaps figure 1.35 A and B should have been reversed (publisher’s error?) and I am not sure I entirely agree about starving patients for 24 hours after a lateral orbitotomy, but I’ll think about it.  

I look forward to future editions.  

Jane Olver  
Western Eye Hospital and Eye Department Charing Cross Hospital, London

Oculoplastic Surgery: review 2

A useful new text had been added to the compendium of the oculoplastics library with the publication of this volume. The author’s intent, as stated in the preface, was to provide a pragmatic approach to diagnosis and management of patients with a range of oculoplastic, orbital, and lacrimal conditions. This book accomplishes the goal of broadly covering many salient topics within the field of oculoplastics.  

The author divides the book into sections on oculoplastic operative principles, eyelids, orbit issues including fractures, orbital disorders, and surgical approaches to the orbit.
The extensive coverage of orbital and mid-facial fractures is particularly comprehensive. A thorough review of thyroid ophthalmology is organised separately and provides a comprehensive approach to the many issues surrounding this disease process. Epiphora, blepharoplasty, eyebrow ptosis, enucleation, evisceration, exenteration, socket reconstruction are also covered in separate sections, which contain many photographs and illustrations. Complications of various surgical procedures add to the topics, but are not ubiquitously covered in equal detail in all of the sections. A section on autogenous grafts in ophthalmic plastic surgery is well presented, and of interest in that infectious concerns are causing a return to popularity of autogenous grafts.

Many surgical photographs are accompanied by adjacent photographs of skulls nicely showing anatomy, or endoscopic photographs, which are also very illustrative. Less useful are the accompanying line drawings, many of which do not greatly clarify their accompanying surgical photographs, which are taken from some distance. At the end of each section is a reference for further reading, which would lead the reader to more in-depth information about the topics and surgical techniques discussed.

Although this book is very thorough in covering functional oculoplastics, it does not concentrate on the many cosmetic issues in ocular plastics. Botox, use of filler material, fat repositioning, laser resurfacing, and use of the carbon dioxide laser in surgery are not covered in this text.

Overall, this is a well thought out and nicely presented basic text on functional oculoplastics. It would complement the knowledge of residents, fellows, and the general ophthalmologist. Those beyond this level of training might find they want for more depth of information than this text offers.

L Dragan
Yale University, USA; ldragan@hotmail.com

**NOTICES**

**HIV/AIDS and the eye**

The latest issue of Community Eye Health (No 47) discusses the impact of the HIV/AIDS epidemic on prevention of blindness programmes. For further information please contact: Journal of Community Eye Health, International Resource Centre, International Centre for Eye Health, Department of Infectious and Tropical Diseases, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK (tel: +44 (0)20 7612 7964; email: Anita.Shah@lshtm.ac.uk; website: www.jceh.co.uk). Annual subscription (4 issues) UK£28/US$45. Free to developing country applicants.

**Elimination of avoidable blindness**

The 56th World Health Assembly (WHA) considered the report on the elimination of avoidable blindness (doc A56/26) and urged Member States to: (1) Commit themselves to supporting the Global Initiative for the Elimination of Avoidable Blindness by setting up a national Vision 2020 plan by 2005; (2) Establish a national coordinating committee for Vision 2020, or a national blindness prevention committee to help implement the plan; (3) Implement the plan by 2007; (4) Include effective monitoring and evaluation of the plan with the aim of showing a reduction in the magnitude of avoidable blindness by 2010; (5) To support the mobilisation of resources for eliminating avoidable blindness. The WHA also urged the Director-General to maintain and strengthen WHO’s collaboration with Member States and the partners of the Global Initiative for the Elimination of Avoidable Blindness as well as aid in the coordination and support of national capability.

**5th International Symposium on Ocular Pharmacology and Therapeutics (ISOPT)**

The 5th International Symposium on Ocular Pharmacology and Therapeutics (ISOPT) will take place 11-14 March 2004, in Monte Carlo, Monaco. Please visit our website for details of the scientific programme, registration, and accommodation. To receive the Call for Abstracts and registration brochure, please submit your full mailing details to http://www.kenes.com/isopt/interest.htm. Further details: ISOPT Secretariat (website: www.kenes.com/isopt).

**14th Meeting of the EASD Eye Complication study group**

The 14th Meeting of the EASD Eye Complication study group will take place on the 21-23 May 2004. There will be key lecture notes on the following topics: Peter Gaede (Denmark—Retinopathy and Steno 2 study, Hans Peter Hammes (Germany)—Animal models of diabetic retinopathy,
Massimo Porta (Italy)--Screening with the London protocols: 12 years after, and Anselm Kampik (Germany)--Surgical options in diabetic retinopathy. There will also be case presentations and oral and poster presentations. The EASDEC board comprises F Bandello (President), PJ Guillausseau (Vice President), C-D Agardh (Past President), P Massin (Secretary), M Porta (Treasurer). The Scientific and Organizing Committee includes: F Bandello, PJ Guillausseau, P Massin, C-D Agardh, M Porta, A Kampik, M Ulbig, and G Lang. There are three travel grants available, at 1000 Euro each, for young scientists (less than 35 years at the time of the meeting). Application for the grant should be made together with the submission of the abstract. For further information, contact: Department of Ophthalmology, Ingrid Mannl, Ludwig-Maximilians-University, Mathildenstr. 8, 80336 MUNICH, Germany (tel: +49–89–5160–3800; fax: +49–89–5160–4778; e-mail: easdec@ak-l.med.uni-muenchen.de. The deadline for abstracts is 2 March 2004.

A revolution in healthcare diagnostics

A simple but revolutionary new design for an ophthalmoscope, that can be easily used to detect serious diseases of the eye, including glaucoma, diabetes and cerebral malaria, has won the NESTA (the National Endowment for Science, Technology and the Arts) prize at the 2003 Medical Futures Innovation Awards.

Mr Roger Armour, an Honorary Consultant Surgeon from Hitchin in Hertfordshire, will receive £10,000 in prize money and his idea will be fast tracked through NESTA’s Invention & Innovation programme, the largest source of early stage seed funding in the UK, for possible further funding of up to £100,000 to take the technology to the next stage of development.

Ophthalmoscopes are used by physicians to examine the retina at the back of the eye. It is a powerful and useful clinical skill that is completely painless for the patient but essential in diagnosing diseases such as glaucoma and cataracts as well as a host of unsuspected diseases of other parts of the body affecting the eye. These include: high blood pressure, diabetes, leukaemia, brain tumours, hardening of the carotid arteries, cerebral malaria and the tragic shaken baby syndrome, which may be revealed to the trained observer.

With 30 lenses to manipulate and a dozen settings, current ophthalmoscopes are complicated to use, expensive and difficult to carry. As a result, most medical students cannot afford to buy them and many doctors never learn how to use this potentially life-saving instrument properly.

Roger’s simple new design can be made significantly cheaper than standard ophthalmoscopes using basic materials and weighs only 30g so is easy to carry in a pocket or purse. It provides a service as good as current instruments but has no complicated settings or lenses to trouble the user.

It has also been successfully tried by over 300 doctors, nurses and non-medical people and won an award at the 2003 Oxford Ophthalmological Congress. NESTA Chairman Chris Powell, who presented the award, said:

“Roger’s idea is a wonderful example of a simple innovation that could make a huge impact and I am delighted to present him with the NESTA award at this year’s Medical Futures. His ophthalmoscope could revolutionise education and training in medicine, giving students an inexpensive and easy to use tool that they can carry everywhere with them. This will give them the chance to practice and perfect their technique in this essential skill without having to be confined to a clinic and could benefit doctors and patients for years to come.”

International Strabismological Association (ISA) Fellowship

The International Strabismological Association (ISA) has established one fellowship for either basic or advanced training in strabismus/paediatric ophthalmology supported by the amount of US $10,000. Applications may be obtained from the Secretary/Treasurer or the ISA, Derek T. Sprunger, MD, at Indiana University School of Medicine, 702 Rotary Circle, Indianapolis, Indiana 46202 or by e-mail at isa.lms@juno.com. The last day for this application is 15 March, 2004.