Charles Bonnet syndrome precipitated by brimonidine tartrate eye drops

Brimonidine tartrate (BT) (Alphagan) is an α-2 adrenergic agonist marketed for treatment of primary open angle glaucoma (POAG) which may have neuroprotective effects. One report of acute delusional psychosis with auditory hallucinations in a 68 year old man treated for POAG has been published, and use of BT eye drops in an infant resulted in coma and other serious systemic abnormalities. Here we report four elderly patients with bilateral visual loss who developed visual hallucinations (Charles Bonnet syndrome; CBS) shortly after beginning the use of BT eye drops. The hallucinations ceased after discontinuation of BT drops in three cases, and after decreasing the dose in one case, within a time frame of days to 4 months.

Case reports

Table 1 summarises visual function and the characteristics of the visual hallucinations in all four patients.

Comment

The Charles Bonnet syndrome is characterised by persistent or repetitive formed visual hallucinations in elderly individuals in the setting of significant bilateral prechiasmal visual impairment. The visual hallucinations in CBS are not routinely accompanied by other psychiatric symptoms and the affected individuals retain full or partial insight into the unreality of the visions. Brimonidine tartrate is a lipid soluble α-2 adrenergic agonist that has a systemic half life of about 3 hours. It is excreted mainly by the kidneys with 87% of an oral dose eliminated after 120 hours. Auditory hallucinations, depression, confusion, and anxiety have been reported with BT use in an elderly adult and coma, hypotension, bradycardia, hypotonia, and hypothermia was caused by BT eye drops given to an infant for treatment of glaucoma. Clearly, BT has the capability of causing central nervous system side effects. Oral clonidine, another α-2 adrenergic agonist, is known to cause visual hallucinations. Brown and coworkers described the case of a 31 year old woman treated with clonidine for poorly controlled hypertension who developed visions of “hands reaching for her from a closet or an old woman following her” in the presence of an otherwise clear sensorium. Also, clonidine use has caused delusional psychoses and auditory hallucinations in other patients.

All of our patients were at risk for the CBS based on age and visual impairment but none had had visual hallucinations before using BT. The onset of CBS ranged from 5 days to 2.5 months from starting BT. The visual hallucinations ceased in three of our patients within days of discontinuing BT (cases 1 and 3) or decreasing the dose (case 4), consistent with the washout period of the drug. In case 2, the hallucinations lasted on and off for about 4 months. Therefore the persistence of the hallucinations cannot be explained directly by persistent drug toxicity in this person. However, it is still possible that BT triggered the start of CBS in this individual. The natural history of duration of CBS is 47.4 months on average, with a range of 1–240 months. It should be noted that patient 2 also was taking a wide variety of drugs at the time BT was prescribed but their role, if any, in causing the visual hallucinations to persist is uncertain. For example, one study found no statistical difference in the number of drugs taken by patients seen in a geriatric psychiatry clinic who suffered from visual hallucinations when compared with a control group of elderly patients without hallucinations (4.4 (SD 3.1) drugs in the group with hallucinations).

In summary, elderly people with bilateral visual impairment should be warned of the possibility of visual hallucinations resulting from BT use.

Acknowledgement

This work was supported in part by a gift from Lavender Kolbe Burke.

Conflict of interest: None of the authors has a conflict of interest involving any aspect of this publication.

Table 1

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>VA</th>
<th>Visual fields</th>
<th>Visual hallucinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>79</td>
<td>F</td>
<td>RE 20/20 LE 20/25</td>
<td>Humphrey 24/2: constriction to 15 degrees; MD –16.68 dB Humphrey 24/2: complete loss of inferior nasal field; MD –12.61 dB</td>
<td>“like dreaming while awake . . . water dripping from the ceiling”</td>
</tr>
<tr>
<td>82</td>
<td>F</td>
<td>RE 20/80 LE FC</td>
<td>Humphrey 81-3 zone; 51/81 points not seen Confrontation; FC ability in all but inferior nasal field</td>
<td>“A changing visual panorama . . . halls green with diamond-like pattern . . . blue flowers lying on the floor . . . the walls looked like they were made of brick”</td>
</tr>
<tr>
<td>78</td>
<td>M</td>
<td>RE 20/25 LE 5/200</td>
<td>Humphrey 81-3 zone; 55/81 points not seen Humphrey 81-3 zone; 50/81 points not seen</td>
<td>“I saw images of my bedroom wallpaper all over my house . . .”</td>
</tr>
<tr>
<td>89</td>
<td>F</td>
<td>RE 20/40 LE 20/40</td>
<td>Humphrey 24/2; MD –3.14 Humphrey 24/2; MD –11.66 Dense inferior field defect</td>
<td>People in the room that were not there . . . people or shadows standing near the elevator</td>
</tr>
</tbody>
</table>

VA = visual acuity; MD = mean deviation; FC = finger counting.
Trends in squint surgical activity

It has recently been reported that there has been a trend in the United Kingdom towards fewer children requiring strabismus surgery. Unless there has been a change in the incidence of childhood strabismus, it may reflect a change in the clinical practices of ophthalmologists, optometrists, and orthoptists. One such practice is the correction of associated refractive errors. The correction of a hypermetropic refractive error is an important aspect in the management of esotropia. Although the full hypermetropic correction is usually prescribed for children with an esotropia, it is unclear whether this is, or has been, uniform in practice. Indeed, certain texts suggest a reduction in the hypermetropic correction following a cycloplegic refraction, to take into account so called accommodative tonus. Because of the effect of an undercorrection of a hypermetropic refractive error on the angle of esotropia, we were interested to determine whether a change in spectacle prescribing practice had had any effect on the number of patients undergoing squint surgery.

Methods

Data were collected from the computerised hospital attendance statistics and operations at the Royal Liverpool Children’s NHS Trust Hospital, which were available from the financial year 1988–9 onwards. The annual number of ophthalmic referrals and operations, were collected within two time periods: a 4 year period from 1988–9 to 1991–2 (period 1) and a 7 year period from 1994–5 to 2000–1 (period 2). Before 1992, it had been the practice to prescribe spectacles with a 0.5–1 dioptre reduction in the spherical component of the cycloplegic refractive error. From the period 1994 onwards, it was the practice of the consultant to prescribe the full cycloplegic hypermetropic error to be prescribed. Data were not collected between 1992 and 1994 to allow for a washout period for those patients who had previously been prescribed an undercorrected hypermetropic correction and were undergoing surgery between 1992 and 1994. The total number of eye and squint operations performed per 100 patient referrals, and the ratio between the squint and non-squint operations performed were calculated. The difference between the two periods was compared using the Fisher’s exact test and confidence intervals calculated by the Miettinen approximation method.

Results

During periods 1 and 2, 4514 and 10 314 new patients were seen, of whom 23.9% and 23.6% underwent some form of ophthalmic surgery (p >0.5). There was a significant difference between the mean number of squint operations per 100 patients in period 1 compared to period 2 (14.8% and 9.3%, p <0.0001, proportion difference 0.060, 95% CI 0.047 to 0.073). There was also a significant difference in the mean number of squint operations per 100 total operations performed in period 1 compared to period 2 (61.9% and 38.2%, p <0.0001, proportion difference 0.243, 95% CI 0.203 to 0.283).

Comment

Although it was not possible to examine the population profiles in the time periods studied, there had been no known change in the population profile or referring practices. The hospital data retrieval system, unfortunately, did not permit us to differentiate between a new patient seen with a squint and another seen with a non-squint problem. While the proportion of children who required surgery had remained constant, there had been, similar to a recent report, a reduction in the number of squint operations being performed, with a corresponding increase in the proportion of non-squint operations. We agree that there were likely to have been a variety of other factors contributing to the reduction in strabismus surgery. However, this trend may reflect in part, a change in practice whereby children with strabismus who had a hypermetropic refractive error were, during the latter period, prescribed their full hypermetropic correction.

J Shankar, S Kaye

St Paul’s Eye Unit, 8Z Link, Royal Liverpool University Hospital, Prescot Street, Liverpool L7 8XP, UK

Correspondence to: Stephen Kaye, St Paul’s Eye Unit, 8Z Link, Royal Liverpool University Hospital, Prescot Street, Liverpool L7 8XP, UK; stephen.kaye@rlbuh-tr.nwest.nhs.uk

Accepted for publication 13 November 2002

References


Botulinus toxin treatment of “one and a half syndrome”

Complex forms of nystagmus and conjugate eye movement deficits are generated if the pontine paramedian structures are damaged. These can cause troublesome and occasionally disabling symptoms. The combination of one sided horizontal gaze palsy and ipsilateral internuclear ophthalmoplegia (INO), known as “one and a half syndrome,” is most commonly caused by demyelination, vascular disease or tumours. Ophthalmological symptoms include diplopia, oscillopsia or blurred vision and are often remarkably challenging to manage. Since the introduction of botulinum toxin A (BTA) for ocular motility disorders and nystagmus there have been a number of reports that establish the use of BTA as a treatment option in the management of complex ocular motility disorders.

We report the use of BTA in a patient with one and a half syndrome.

Case report

A 52 year old white male patient was admitted to our institution with dysarthria and right arm weakness of sudden onset. Three years before he had suffered a post-coital subarachnoid haemorrhage from a right middle cerebral artery aneurysm. He had had his aneurysm clipped and had managed an almost complete recovery. He was overweight and hypertensive.

When he was admitted it was noted that he had right facial weakness and his right eye was abducted. Cranial imaging showed considerable volume loss and gliosis in the right frontoparietal region and a possible small infarct in the right side of pons. A few days after the incident and when the patient regained consciousness he complained of oscillopsia from his right eye and an ophthalmological opinion was requested. Examination of this patient was hampered by his poor mobility and severe dysarthria. He was found to have a complete left gaze palsy and a left InO. He was divergent in the primary position with an angle of approximately 45 prism dioptries (Krimsky). Vertical eye movements were preserved, although he was reluctant to elevate or depress his eyes and the examination of convergence was inconclusive (Fig 1). His main symptom was oscillopsia due to the abducting nystagmus of his non-paretic right eye, which was only relieved with occlusion of the eye with a patch.

A clinical diagnosis of one and a half syndrome secondary to a cerebrovascular event was made. His concurrent exotropia was well described, even if uncommon feature of
this syndrome and is explained by a tendency of the contralateral eye to drift in the opposite direction due to the horizontal gaze palsy. Thus, one and a half syndrome has also been called paralytic pontine extroptia.

Botulinum toxin was injected into the right lateral rectus muscle under EMG control. Three weeks after the injection the patient's symptoms had improved. In the primary position he showed only a very small amount of divergence. He had disposed of the patch as he had no oscillopsia. There was an abduction deficit in the right eye, presumably as a result of the BTA injection with elimination of the abducting nystagmus (Fig 2).

Three months after BTA injection he remained symptom free. He was still very slightly divergent in the primary position. His left gaze palsy showed some mild improvement without abducting nystagmus of the right eye. He did not report diplopia or oscillopsia.

Comment

Eye symptoms following damage to pontine structures have been shown to fluctuate with time and often spontaneously resolve. However, persistent symptoms can also occur. Intractable diplopia or oscillopsia of even a few months' duration can prove functionally disabling to the patients especially when bed bound. The transient nature of the BTA therapeutic effect makes it the most suitable management for these complex ocular motility problems.

In our patient, although his one and a half syndrome was associated with extroptia, the main disturbance was caused by his acquired abducting nystagmus. It could be argued that the duration of symptoms between presentation and administration of the toxin was not sufficient to ensure that the condition would not have resolved spontaneously. However, the timing of symptom resolution despite the persistence of INO features suggest that the improvement was more probably due to the effect of the toxin. What is more, because of the severe general disability following his stroke, this patient was the ideal subject for such treatment: by injecting his last working muscle but can cause oscillopsia during head movements. Our patient was so severely immobilised that this was not an issue, both because of limited head movement and the fact that the vestibulo-ocular reflex is less essential in bed bound patients. There was a definite subjective improvement in the quality of life with the abolishment of his abducting nystagmus. We have not been able to explain the absence of diplopia after treatment, in spite of a small residual divergence.

There has been a previous report of a patient with one and a half syndrome treated with BTA but on that occasion the toxin was administered into the retrobulbar space of the eye ipsilateral to the INO. To our knowledge this is the first report of one and a half syndrome treated with a BTA injection in a selected extraocular muscle.

In conclusion, injection of botulinum toxin to selected extraocular muscles can provide a useful alternative to occlusion, drug, or surgical therapies for patients with complex ataxic nystagmus resulting from pontine lesions. Patients suffering from oscillopsia due to ataxic disconjugate nystagmus may benefit from this approach as most other treatments are unsuitable for such cases. There does not seem to be any particular benefit in waiting for stabilisation of symptoms and signs. Selected toxin injection may improve the quality of life during the rehabilitation period.

A Kipioti, R H Taylor
York District Hospital, Wigginton Road, York YO3 7HE, UK

Correspondence to: Miss Tina Kipioti, Eye Department, Clarendon Wing, Leeds General Infirmary, Leeds LS2 9NS, UK; tinalkipioti@doctors.org.uk

Accepted for publication 16 November 2002

References


Figure 2 Still photographs of eye movements 3 weeks after injection of botulinum toxin. Permission for photograph given by patient.

Retinal and subdural haemorrhages: Aoki revisited

In the United States and much of the English speaking world, the combination of retinal and subdural haemorrhages in a very young child is highly suggestive of non-accidental injury and felt to be incompatible with a history of a minor fall. Thus, when Aoki et al published 26 cases of infants, age 3–14 months, with this combination following minimal falls, even though they stated in their article “in this series, none of the patients had a significant medical history or were victims of child abuse before the trauma” there was immediate concern that these may have been undiagnosed cases of shaken baby syndrome (SBS). Aoki responded to this by saying “we do not believe the injuries were caused by battering or shaking” although noting their “series might include some injuries caused by abuse.” In 1987, Ikeda et al added cases to the Japanese experience noting these were “usually caused by a simple domestic head injury and indicating they were aware of the battered child syndrome.

A comparison of the age distributions of the Aoki and Ikeda series shows them to be very similar (a simple t test not being able to rule they are different with even a 20% probability). However, if either Japanese series or a combination of the two are compared to Kiviluoto’s SBS series in the United States, it is apparent these are not the same (the probability by a simple t test shows there to be between less than one chance in 400 and a chance in a million that these age distributions are the same) (Tables 1 and 2).

Recent articles have again brought into question the assumption that a history of a minimal fall is compatible with the finding of subdural haematoma and retinal haemorrhage in an infant. However, even if some of the Japanese cases are from abuse, some of the American cases may be from minimal falls. The United States assumption would require all the Japanese cases to be misdiagnose and all 26-40 independent cases in Japan (which are similar to many of the United States stories) to be similar predictions. Instead of discarding the Japanese experience, an inquiry as to why the age distributions are so different seems appropriate.

H B Gardner
Manitou Springs, CO, USA; horacebgardner@yahoo.com

Accepted for publication 17 November 2002
Treatment of vascular tufts at the pupillary margin before cataract surgery

Iris vascular tufts or microhaemangiomas are an infrequent finding on ophthalmic evaluation. Previous reports have attributed vascular tufts at the pupillary margin of the iris to diabetes, myotonic dystrophy,1 in association with Sturge-Weber syndrome,2 or in association with haemangioma of the orbit or eyelid. We describe a patient with multiple cutaneous and iris margin haemangiomas who had a history of recurrent hyphaema and underwent successful argon laser treatment of pupillary margin haemangiomas before extracapsular cataract extraction with intraocular lens implantation.

Case report

The patient is a 75 year old man first seen 2 years earlier by the retinovascular service at the Wilmer Eye Institute, Baltimore, MD, USA, for recurrent hyphaema in the left eye. He was noted to have multiple haemangiomas on the pupillary border of both eyes as well as numerous cutaneous haemangiomas on his trunk. A small hyphaema was appreciated inferiorly in the left eye with no active bleeding. Gonioscopic examination was normal except for blood in the inferior angle and the intraocular pressure was 16 mm Hg in each eye. There was no corneal endothelial blood staining. He was treated with homatropine hydrobromide ophthalmic solution 5% (Ciba Vision, Duluth, GA, USA) twice a day and prednisolone acetate 1% (Falcon Pharmaceuticals, Fort Worth, TX, USA) four times a day for 1 week to decrease light sensitivity and to prevent intraocular inflammation. The hyphaema subsequently resolved without sequelae. It was suggested that if he suffered a rare occasional haemorrhage he would be treated symptomatically, but multiple repeat haemorrhages would be treated with laser coagulation or surgical excision.

He now presents to the cornea, cataract, and refractive service at the Wilmer Eye Institute for reduced visual acuity primarily in the right eye. On examination, Snellen visual acuity measured 20/400 in the right eye with an afferent pupillary defect. External examination was significant for multiple 1–2 mm haemorrhages would be treated with laser coagulation or surgical excision. A total of 50 spots were administered to close all tufts appreciated clinically and angiographically. No bleeding was noted during the procedure. The patient subsequently underwent uncomplicated extracapsular cataract extraction through a clear corneal incision under topical anaesthesia. Upon insertion of the intraocular lens, a small amount of blood was noticed in the anterior chamber, most probably secondary to iris trauma during the manoeuvre. This was washed out with balanced salt solution. No blood was noticed in the anterior chamber on the first postoperative day nor during a 10 month postoperative follow up period.

Comment

Vascular anomalies of the pupillary margin are rarely seen but have been previously implicated as a possible cause of spontaneous hyphaema.3 More unusual are iris haemangiomas associated with cutaneous haemangiomas. Generalised cutaneous and visceral but evidence of pigment clumps on the anterior capsule in each eye. The right crystalline lens showed dense nuclear sclerosis and posterior subcapsular cataractous change. Funduscopic examination demonstrated a cup to disc ratio of 0.7 in the right eye. The disc, macula, and vessels were normal except for mild arteriolar narrowing. The examination of the left eye was significant for venous congestion with a small superficial nerve fibre layer haemorrhage on the inferior border of the disc. This possibly represented an impending vein occlusion.

References


Table 1

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>Kivlin</td>
<td>9</td>
<td>13</td>
<td>18</td>
<td>16</td>
<td>10</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Aoki</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Ikeda</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th></th>
<th>t value</th>
<th>Degrees of freedom</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aoki = Ikeda</td>
<td>0.79</td>
<td>13</td>
<td>&gt;0.200</td>
</tr>
<tr>
<td>Ikeda = Kivlin</td>
<td>3.43</td>
<td>13</td>
<td>&lt;0.0025</td>
</tr>
<tr>
<td>Aoki = Ikeda</td>
<td>4.66</td>
<td>25</td>
<td>&lt;0.0005</td>
</tr>
<tr>
<td>A + I = Kivlin</td>
<td>6.09</td>
<td>39</td>
<td>&lt;0.00001</td>
</tr>
</tbody>
</table>

Figure 1

Multiple cutaneous haemangiomas on the trunk.

Figure 2

Slit lamp biomicroscopic image of pupillary margin vascular loops (arrows).

Figure 3

Iris angiogram showing multiple leaking vascular tufts at the pupillary margin.
Treatment of retinal folds using a modified macula relocation technique with perfluorohexyloctane tamponade

Retinal folds are a relatively uncommon complication of retinal surgery. Macula involvement can produce poor acuity and disturbing metamorphopsia. We report a novel treatment for macula fold using the surgical techniques of foveal translocation and perfluorohexyloctane (F\textsubscript{6}H\textsubscript{8}), a new heavier than water agent licensed for long term internal tamponade.3,4

Case report

A 51 year old man with Terson’s syndrome was found to have retinal detachment on B-scan ultrasonography. He underwent vitrectomy and lensectomy with C\textsubscript{2}F\textsubscript{6} gas tamponade. (Standard flash in dark adapted b-wave amplitudes V before and 453\,\mu V after; b-wave amplitudes achieved without sclera imbrication to generate redundancy, by introducing a gas bubble in the presence of a bullous retinal detachment. The bubble occupies the top half of the vitreous cavity. The SRF is displaced inferiorly and, confined by the anterior attachment of retina, puts the macula on stretch.

Similarly, in our patient, we induced a bullous retinal detachment, used a bubble of

heavy liquid and postured the patient supine. The FTR occupied the dependent part of the vitreous cavity and displaced the SRF peripherally and anteriorly. The SRF is confined by the attachment of the retina at the ora serrata. This effectively put the retina on stretch and "ironed out" the macular fold (Fig 2).

Kertes and Peyman reported treatment of retinal folds in two patients having surgery for tractional retinal detachment (one diabetic, one toxocara granuloma). They used per-operative perfluoro-perhydrophenanthrene tamponade and direct retinal manipulation with a silicone tipped cannula. No significant visual improvement was noted as the folds were outside the macula. Our technique involves no direct instrumental manipulation of the central retina. We have been able to effectively treat the macula fold by exploiting the specific gravity of the tamponade agent. Avoidance of macula folds by addressing causative factors is obviously preferable to treatment. We have been impressed with the complete disappearance of the fold in this case. In selected cases surgery may be appropriate to alleviate troublesome metamorphopsia and possibly reduce the risk of permanent and progressive reduction in vision resulting from the macular fold.

E N Herbert, C Groenewald, D Wong
Royal Liverpool University Hospital, Prescott Street, Liverpool L7 7PN, UK

Correspondence to: Edward N Herbert, Royal Liverpool University Hospital, Prescott Street, Liverpool L7 7PN, UK, enherbert@doctors.org.uk

Accepted for publication 4 December 2002

References

Is hyaline degeneration of the cornea a precursor of Salzmann’s corneal degeneration?

Hyaline degeneration of the cornea has been described by Smolin and Thoft as a specific and rare pathological entity. Other authors have used the term hyaline degeneration of the cornea synonymous with climatic droplet keratopathy, or spheroidal degeneration of the cornea. A literature search failed to reveal any cases of initially diagnosed hyaline degeneration of the cornea as a precursor of Salzmann’s corneal degeneration. We present the first case known to us of initially diagnosed hyaline degeneration of the cornea, assumed to be a precursor of Salzmann’s corneal degeneration.

Case report
A 34 year old woman was referred to our department in April 1998 with increasing opacity of the left cornea. Her medical and ophthalmological history was uneventful. The lower third of the left cornea showed a slightly elevated, yellowish, subepithelial opacity, sharply demarcated and separated from the limbus by a marked interspace (Fig 1A). The right eye was without pathological findings. The corneal opacity was removed by a scarifier both because of persistent foreign body sensation and for diagnostic purposes.

The histological examination of the removed corneal tissue revealed marked, diffuse hyalnosis of the stroma (Fig 1B), and focal degenerations of the overlying corneal epithelium. The presence of amyloid substance was excluded by Congo red staining. Electron microscopy demonstrated the described hyaline areas to represent collagenous tissue (Fig 1C). The assessment of the clinical and histological appearance of the corneal changes led to the diagnosis of hyaline degeneration of the cornea, according to the classification of Smolin and Thoft.

After a period of 2 years the patient presented with recurrent corneal opacity extending beyond the initial pathological area. The clinical appearance of the opacity was markedly different, consisting of several, peripheral, subepithelial, white, slightly prominent lesions. The corresponding juxtapalimbic cornea was characterised by cloudy opacification and the start of vascularisation (Fig 1D). The cornea of the right eye, which was without pathological findings 2 years earlier, now exhibited a circumscribed injection of limbal vessels as well as a punctiform superficial opacity at a paracentral location (Fig 1E). The described findings were unchanged at the time of the most recent examination of the patient in August 2002. The clinical aspect of the left eye and the bilateral occurrence of corneal disease enabled the diagnosis of Salzmann’s corneal degeneration.

Comment
The diagnosis of Salzmann’s corneal degeneration is made clinically, with subepithelial, prominent corneal lesions representing the most important sign of this disease. We believe that the initial corneal alteration, clinically diagnosed as hyaline degeneration of the cornea, represents a precursor of Salzmann’s corneal degeneration. This assumption is based on the fact that the respective histological findings already indicated the presence of this pathology, in the region of nodular thickening the superficial stromal tissue consists of collagen fibrils which are hyalinated and arranged in an irregular fashion in the absence of inflammatory changes or vascularisation. The corneal epithelium shows focal degenerations, while Bowman’s membrane is not identified at its usual subepithelial location.

This case gives rise to the question as to whether hyaline degeneration may exist as a...
been reported following laser in situ keratomileusis (LASIK) surgery. Aspergillus keratitis may be seen following trauma or corneal dystrophy. The spontaneous occurrence of Salzmann’s corneal degeneration we report has only rarely been described. A possible explanation for this may be that two variants of Salzmann’s corneal degeneration exist: a secondary variant, associated with different corneal pathologies, and a primary one. Further work is required to determine whether the aetiology of the primary variant might be related to limbic insufficiency, which eventually causes both eyes to be affected, as is suggested by the onset of clinical signs of corneal conjunctivalisation in our patient.

M Frising, S Pitz, D Olbert
Department of Ophthalmology, Johannes Gutenberg-University, Langenbeckstrasse 1, D-55101 Mainz, Germany

J Kriegsmann
Institute of Pathology, Maltekestrasse 32, D-54292 Trier, Germany

W Lisch
Municipal Hospital Hanau, Leimenstrasse 20, D-63450 Hanau, Germany

Accepted for publication 4 December 2002

References


Hospital acquired aspergillus keratitis

Aspergillus fumigatus is a ubiquitous mould that rarely causes ocular pathology. Aspergillus keratitis may be seen following trauma or surgery to the eye and has recently been reported following laser in situ keratomileusis. Endophthalmitis is also a rare event after trauma or surgery. Endogenous aspergillus endophthalmitis is seen in patients who are immunocompromised, have endocarditis, or a history of injecting drug use. An outbreak of ocular aspergillosis following cataract surgery has been reported in association with building a new hospital in the Middle East. We report a case of aspergillus keratitis associated with hospital construction in the United Kingdom.

Case report

A 43 year old man presented with a right sided corneal ulcer and a vision of hand movements (Fig 1). He had a past history of bilateral herpes simplex keratitis, rosacea related keratopathy, bilateral corneal grafts, and cataract surgery. The right corneal ulcer was treated with intensive topical ofloxacin and prednisolone acetate 1%. Alpha haemolytic streptococci and coagulase negative staphylococci were cultured from the corneal scrape. The central cornea thinned and a hypopyon became visible. The cornea then perforated and a bandage contact lens and glue was placed on the cornea while graft material was being obtained. A penetrating keratoplasty was performed with a 9 mm donor placed into an 8.5 mm recipient bed with interrupted sutures (Fig 2). Soon after surgery the microbiology laboratory grew Aspergillus fumigatus from two plates from the corneal scrape. The patient was taken back to theatre for intravitreal amphotericin B injection and topical amphotericin was commenced. The patient made an excellent recovery and has maintained a vision of 6/9 in the right eye with a refraction of −3.25/+3.00×105.

Comment

This patient has unfortunately had infection of the cornea with virus, bacteria, and fungus. The previous herpetic and rosacea related keratopathy resulted in his original corneal grafts and were a risk factor for the development of bacterial keratitis. Considerable demodolition and construction work was taking place at the time the patient was admitted to the Royal Devon and Exeter Hospital. The old hospital tower block was being pulled down and the aspergillus infection was probably due to contamination from fungal spores released during the demolition work.

Penetrating keratoplasty is a recognised treatment for fungal keratitits, although the graft was performed for the corneal perforation and the fungal infection was only noted after the graft. We believe this is the first documented combined bacterial and fungal keratitis in the United Kingdom that may be attributed to contamination by fungal spores released by hospital demolition work.

B Burt, G Pappas, P Simcock
West of England Eye Unit, Royal Devon and Exeter Hospital, Exeter EX2 5DW, UK

Correspondence to: Peter Simcock, West of England Eye Unit, Royal Devon and Exeter Hospital, Barrack Road, Exeter EX2 5DW, UK; psimcock@hotmail.com

Accepted for publication 4 December 2002

References


Thyroid eye disease: an unusual presentation

Viagra (Sildenafil) is an oral preparation for the treatment of male erectile dysfunction. Although the drug is marketed solely for its therapeutic purposes, it has high potential for abuse owing to its ability to intensify and prolong erectile response. We describe here an ocular side effect following its use as a recreational drug, which led to the diagnosis of thyroid eye disease.

Case report

A 30 year old white man was referred to the eye clinic, with a history of waking up one morning with a left proptosis, having had no ocular signs or symptoms the previous day. The patient did not have any subjective symptoms of pain, redness, change in visual acuity, double vision, or of hearing any sounds. There was no history of direct or indirect trauma. He gave a history of having acquired a tablet of Viagra from a friend at a Christmas party. He ingested half and gave half to his partner. The exact dosage strength was unknown. His partner noticed increased visibility of the white of the eye under the left upper lid. He was otherwise healthy and was taking no medication.
Visual acuity was 6/5 unaided in each eye. Ocular examination showed a 3 mm axial non-pulsatile left proptosis. He was orthophoric and ocular movements were unrestricted. Anterior segment examination showed generalised conjunctival engorge ment on both sides, more on the left than on the right. Pupils were normally reacting and fundus examination was unremarkable. Intracocular pressure was normal with no significant difference between straight gaze and up gaze. Auscultation over the globe revealed no bruit.

The clinical findings along with the acute onset history led us to suspect superior ophthalmic vein thrombosis as a possible cause. An magnetic resonance imaging (MRI) scan was ordered with a specific request to comment on the calibre of the superior ophthalmic veins. The MRI scans showed normal superior ophthalmic veins bilaterally but thickening of all extraocular muscles, particularly the inferior recti on both sides. The inferior rectus was intensely white on T2 weighted scans. Biochemical tests for thyroid function showed him to have high T3 and T4 levels. Intraocular pressure was normal with no significant difference between straight gaze and up gaze. The MRI scans showed ophthalmic vein thrombosis as a possible onset history led us to suspect superior ophthalmic vein thrombosis.

Comment

Sildenafil citrate has been in use since early 1998 for the treatment of male erectile dysfunction. It is a selective cyclic guanosine monophosphate dependent phosphodiesterase type 5 (PDE5) inhibitor. It potentiates the smooth muscle relaxant effect of nitric oxide and leads to engorgement of the sinuses on the corpus cavernosa with a resultant penile erection. At the time of orgasm, emission, and ejaculation sympathomimetic substances—adrenaline (epinephrine) and noradrenaline (norepinephrine)—are released with consequent sinusoidal smooth muscle constriction and rapid loss of penile rigidity.

As with any new drug, clinical and known side effects with regard to sildenafil are limited. Ocular side effects are few. Although sildenafil was developed as a selective PDE5 inhibitor, it has about 10% effect against PDE6—an enzyme localised in retinal photoreceptors. This results in various visual symptoms like a blue tinge to vision, impaired colour vision, increased light sensitivity, and blurred vision. Symptoms are transient and occur between 2-4 hours after ingestion. Results of ocularelectrophysiological tests have been variable. A recent study showed no effect of sildenafil on mean blood pressure, intraocular pressure, perfusion pressure, or choroidal and optic nerve head blood flow, but there have been isolated reports of anterior ischaemic optic neuropathy, vascular third nerve palsy, and retinal vascular occlusions.

Lid retraction following ingestion of Viagra has not been reported before. We believe that the release of sympathomimetic substances may have produced a supranormal response in the form of noticeable lid retraction in a sensitised individual with thyroid dysfunction. We speculate, based on the close temporal relation between ingestion of this recreational drug and the presentation to our department, that Viagra therapy was responsible for the unmasking of latent thyroid eye disease in a sensitised individual.

References

Does etanercept induce uveitis?

Etanercept (Enbrel) is a fusion protein of the extracellular ligand binding portion of the human tumour necrosis factor (TNF) receptor p75 and the Fc portion of human IgG1. This agent inhibits the action of both TNFα and TNFβ (important pro-inflammatory cytokines). It is being increasingly used in the management of rheumatoid arthritis, psoriatic arthritis, and ankylosing spondylitis with a good outcome in both open label and placebo-controlled trials.

Differential efficacy of tumour necrosis factor alpha (anti-TNFα) blockade by these drugs leading to an increase of the population of auto-reactive T cells that may be myelin specific is the proposed mechanism of exacerbation of multiple sclerosis in some patients. A similar pathogenesis may explain the uveitis noted here. Recent research indicates unique cell adhesion molecules and cytokine profiles in autoimmune inflammation occurring in different sites in the body.

This case report aims to create an awareness of the possibility of exacerbation of uveitis and may warrant us to specifically look out for uveitis in patients receiving anti-TNFα therapy.

A R Reddy, O C Backhouse

Leeds General Infirmary, Leeds, UK

Correspondence to: Aravind R Reddy, Leeds General Infirmary, Leeds, UK; aravind_1971@yahoo.com

Accepted for publication 13 December 2002

References

Photodynamic therapy: a treatment option in choroidal neovascularisation secondary to punctate inner choriodopathy that failed to respond to oral corticosteroids and had poor results with submacular surgery in the contralateral eye.

Case report
A 40 year old white female patient with punctate inner choriodopathy was referred to our macular clinic with rapidly deteriorating vision in her left eye secondary to a subfoveal choroidal neovascularisation. She had a history of poor vision in the right eye following submacular surgery to remove a subfoveal choroidal neovascular membrane. Best corrected vision was hand movements in the right eye and 6/18 in the left eye. The logMAR acuity in the left eye was 0.46 (38 letters missed). The anterior segments and intraocular pressures were normal. Both fundi showed characteristic multiple pigmented atrophic scars in the posterior pole and mid-periphery in the absence of vitreous cells. There was a macular scar in the right eye (Fig 1). In the left eye there was an elevated grey lesion with subretinal fluid and intraretinal haemorrhages (Fig 2A). Fluorescein angiography confirmed a predominantly classic subfoveal choroidal neovascular membrane (Fig 2B and C). Argon laser photocoagulation was contra-indicated because of the subfoveal location. Despite a 4 week course of oral prednisolone (40 mg a day for 1 week then reduced by 10 mg every week) the vision in the patient’s only useful eye continued to worsen. The patient refused submacular surgery because of the poor postoperative result in her right eye. Photodynamic therapy was offered as a treatment option.

After obtaining informed consent we performed five sessions of photodynamic therapy at 3 monthly intervals according to a standard protocol. Baseline and 3 monthly post-treatments logMAR visual acuities were recorded and clinical and angiographic assessment was performed. After 15 months the Snellen acuity in her left eye has stabilised at 6/18 and her logMAR acuity is 0.2 (25 letters missed). She has gained eight letters on the logMAR chart and subjectively there is less distortion. Clinically, there is resolution of the subretinal fluid and intraretinal haemorrhages and formation of a flat scar-like lesion (Fig 3A). Angiographically, despite the minimal pigment leakage, the findings are consistent with reduced activity and fibrosis of the choroidal neovascularisation (Fig 3B and C). An Indocyanine green angiography confirmed the...
findings of the fluorescein angiography and excluded the presence of choroidal feeder vessels that could lead to a recurrence of the neovascularisation (Fig 4).

**Comment**

Punctate inner choroidopathy is an idiopathic inflammatory disorder that usually occurs in young, myopic women. Both eyes are commonly affected. Symptoms include blurred or distorted vision, light flashes, or paracentral scotomas. The acute, multiple, yellow-white lesions of the inner choroid and retina of the posterior pole evolve into atrophic pigmented scars. Vitritis and anterior uveitis are absent. Visual prognosis is good in most patients and significant visual loss is usually due to formation of choroidal neovascularisation. Choroidal neovascularisation if smaller than 100 µm in diameter may resolve spontaneously. However, subfoveal choroidal neovascularisation occurs in 40% of the patients. Argon laser photocoagulation is contraindicated for subfoveal lesions. Although good results have been reported with 1 mg/kg per day of oral prednisolone, the response to oral steroids is variable if more than 200 µm in diameter. Submacular surgery has shown promising results but recurrence is common.

Photodynamic therapy using verteporfin is safe and effective for subfoveal choroidal neovascularisation in age related macular degeneration and high myopia. The verteporfin guidelines suggested photodynamic therapy for other aetiologies if outcome without treatment was likely to be poor. Preliminary success in ocular histoplasmosis syndrome, angioid streaks, idiopathic and other conditions has been reported. The recommended protocol for treatment included clinical and procedural...
angiographic review every 3 months.\textsuperscript{1,7} Retreatment was indicated if there was any fluorescein leakage from the choroidal neovascularisation.\textsuperscript{1,7} Retreatment was deferred if the visual acuity remained stable or improved and the lesion fulfilled all the following criteria: (1) minimal or no subretinal fluid on biomicroscopic examination; (2) flat scar-like appearance; (3) minimal fluorescein leakage without progression beyond the boundaries of the previous treatment or involving the fovea.

Photodynamic therapy in this case of subfoveal choroidal neovascularisation secondary to punctate inner choroidopathy was indicated at a point where no visual result in the first eye and the deterioration of vision in the fellow eye despite oral corticosteroid treatment. Five treatment sessions over 15 months produced substantial subjective and visual (logMAR) improvement. Clinically there was resolution of intraretinal haemorrhages and subretinal fluid with formation of a flat scar-like lesion. The angiogram confirmed a stable lesion with minimal fluorescein leakage. No progression beyond the boundaries of the previous treatment and stabilisation of the scar tissue. This case demonstrates that verteporfin photodynamic therapy may be a useful treatment option in choroidal neovascularisation due to punctate inner choroidopathy. Further studies are needed to confirm and support this observation.

S Chatterjee, J M Gibson
Birmingham and Midland Eye Centre, City Hospital NHS Trust, Birmingham B3 2NS

Correspondence to: Dr Jonathan Gibson; doctorjng@hotmail.com

Accepted for publication 2 December 2002

References

7 Anon. Guidelines for using verteporfin (Visudyne) in photodynamic therapy to treat choroidal neovascularisation due to age-related macular degeneration and other causes. Retina 2002;22:6–18

If you have a burning desire to respond to a paper published in the BJO, why not make use of our “rapid response” option? Log on to our website (www.bjophthalmol.com), find the paper that interests you, and send your response via email by clicking on the “eLetters” option in the box at the top right hand corner.

The editors will decide as whether to also publish it in a future paper issue.

Non-invasive volumetric blood flow measurement in the orbit

We read with great interest the article of Orge and co-workers\textsuperscript{1} who claim a first ever solution to the problem of non-invasive volumetric blood flow measurement in the ophthalmic artery. This is a very important topic both from the clinical and scientific point of view, since blood supply is an important factor, for example, in glaucoma studies. However, to date for the orbital circulation only the blood velocity has been measurable; from this the resistivity indices can be calculated, but the volumetric flow cannot be determined because the small diameter of the orbital vessels does not allow the vessel diameter measurement, which is indispensable for such calculation.

In spite of the novelty of the report and the extensive analysis of the authors on the possible sources of high variability of volumetric flow measurements, it appears to us that there are several points which need further consideration of these two methods in the editorial by Hedges,\textsuperscript{3} but we would like to highlight two additional questions.

For us, a weak point of the study protocol of Orge and colleagues is their method for the determination of the diameter of the ophthalmic artery. They assume the boundaries of the vessel to be where detected movement starts and ends along the m-mode line; or in other words the vessel boundaries are taken to be the positions where the grey pixels and colour pixels touch on this Doppler image. However, we are doubtful whether this is relevant for the required quantitative measurement. The first point is that for small vessels the width of the colour area (indicating blood motion) is unfortunately relatively independent of the true vessel diameter. The width of the superimposed colour area is greatly influenced by the actual technical parameters used in colour Doppler imaging (pulse repetition frequency, lateral dimension of the ultrasound beam, colour priority, motion discriminator setting, colour saturation, brightness, contrast, etc.). Our second doubt is that, even on the grey scale part of the image shown by Orge et al in their Figure 1, no vessel wall is seen, unlike the case for typical images of larger vessels like the carotid.

We think that because of these difficulties regarding the determination of the vessel wall position, Orge and co-workers overestimate the ophthalmic artery diameter. Their diameter estimate is 2.02 mm on average, but this figure is significantly larger than is suggested by other evidence. During conventional 10 MHz B-scan diagnostic examination, the ophthalmic artery is never visible. However for the dilated ophthalmic vein, in exceptional cases such as in a patient with carotid-cavernous sinus fistula, or in a small baby in a bout of strenuous crying, the vein is then well outlined with a diameter of 1 mm or above. Thus, we would expect a 2 mm diameter artery to be clearly visible on an average; but this figure is significantly larger than is suggested by other evidence.

In a vessel like the ophthalmic artery there is a further problem in determination of the average velocity, because the laminar flow in such small vessels causes a very wide velocity variation within the lumen, as can be seen from our Figure 1. In contrast, we note that the colour spectrum in the figure presented by the authors is almost completely uniform and does not show higher speed in the centre of the lumen compared to that close to the vessel wall. This might imply a relative insensitivity of velocity discrimination with this type of vessel compared to larger vessels, which in addition may be of irregular cross sectional shape (that is, not circular) but is only measured in one longitudinal plane. We agree with the authors that the analysis software is of great importance and may be a key factor in dealing with this complex situation. In spite of our reservations we, and many other workers concerned with orbital circulation, are in urgent need of a reliable solution for volumetric blood flow determination in the orbit. The results of Orge and co-workers show that we are probably not far from a definitive solution.

Acknowledgement

Supported by the Hungarian Scientific Research Fund (OTKA T 034483)
The Royal College of Ophthalmologists’ also state that on repeated testing a difference of one line can also be included—that is, 6/9 6/6. Therefore a one line difference on Sheridan Gardiner may actually fulfil the linear criteria.

The authors stated that part time occlusion was the method of treatment. Part time occlusion can vary from as much as 6 hours to 10 minutes yet the authors did not state the amount of occlusion to the level of vision. Methods of occlusion have varied greatly between 1972 and 1995, so were the guidelines for occlusion treatment the same throughout the study period?

Furthermore “compliance” with treatment is recognised as an important factor affecting the final visual outcome in amblyopia and that compliance varies with age. The authors have not analysed if compliance varied significantly with age of presentation.

It has been shown that anisometric amblyopes can have improvement in vision after a period of spectacle correction and refractive adaptation is considered an important component of amblyopia treatment. The authors did not state if occlusion was started at the first, second, or third visit after spectacle correction. We do not know if treatment had been initiated prematurely and resulted in falsely increased occlusion dose, thereby giving poorer compliance. This could have skewed the figures. So, we recommend exercising caution in interpreting the results and in concluding that time at which screening is carried out is not critical in this group.

References


Authors’ reply

We thank Sankari and colleagues for their helpful and interesting comments regarding our paper. We accept that the literature suggests a difference of 1 D as a definition of anisometropia but felt the stringent definition we applied would more accurately represent a degree of anisometropia that could potentially lead to amblyopia, and therefore makes the findings more robust. The average age of the cohort was 5½ years and as such the majority of tests were linear. Pure anisometropic amblyopia does not tend to cause as significant crowding as strabismic. We therefore felt that it was not necessary to equate one line of difference with Sheridan Gardiner to a two or three line difference on a linear test. Occlusion regimes and compliance are always problematic especially in retrospective studies.

All parents of children were given the same advice and support regarding their vision and the outcomes, therefore the findings of our study reflect a real clinical situation. Compliance does vary with age as shown by Nucci et al., but this was significant only in the 1–2 year old age group. There were no children of this age in our study. More importantly, the effect of occlusion is inversely related to age, so the younger the child the more the response. Most children were commenced on occlusion at their first visit after refractive correction, which was within 2 months of receiving glasses. We agree that anisometric amblyopes may have a continuing improvement in their vision with just spectacle correction for some months. Depending on the response to spectacle correction, this department will now delay occlusion for up to 6 months. To suggest that initiating occlusion on earlier than may have been necessary would result in a worse outcome because of poor compliance must be considered speculative. In any case, failure to comply with occlusion would result in the non-recommended treatment—that of spectacle correction alone. While there may be some debate as to the efficacy of occlusion therapy, there is currently no evidence that it is detrimental to the final visual acuity achieved in anisometropes.

C J Cobb, K Russell, A Cox, C J MacEwen

Department of Ophthalmology, Ninewells Hospital, Dundee DD1 9SY, UK

Correspondence to: Dr Alan Cox, Department of Ophthalmology, Ninewells Hospital, Dundee DD1 9SY, UK; alan.cox@tuht.scot.nhs.uk

References


“Compliance” with treatment in amblyopia is an important factor affecting the final visual outcome

We discussed the article by Cobb et al. with great interest in our journal club meeting. We would like to highlight some of the issues we discussed.

Evidence in the literature suggests anisometropia is a difference of 1 DS between both eyes but the authors use a difference of 2 DS. Also the minimum criteria for diagnosing amblyopia on a test of visual acuity are accepted to be two lines difference between the eyes on linear tests. However, the authors use these criteria for the single optotype test and do not take into account the crowding effect. A two line difference on Sheridan Gardiner may actually equate to a three line difference on a linear test. The authors did not state if occlusion was started at the first, second, or third visit after spectacle correction. We do not know if treatment had been initiated prematurely and resulted in falsely increased occlusion dose, thereby giving poorer compliance. This could have skewed the figures. So, we recommend exercising caution in interpreting the results and in concluding that time at which screening is carried out is not critical in this group.

References


“Compliance” with treatment in amblyopia is an important factor affecting the final visual outcome

We discussed the article by Cobb et al. with great interest in our journal club meeting. We would like to highlight some of the issues we discussed.

Evidence in the literature suggests anisometropia is a difference of 1 DS between both eyes but the authors use a difference of 2 DS. Also the minimum criteria for diagnosing amblyopia on a test of visual acuity are accepted to be two lines difference between the eyes on linear tests. However, the authors use these criteria for the single optotype test and do not take into account the crowding effect. A two line difference on Sheridan Gardiner may actually equate to a three line difference on a linear test. The authors did not state if occlusion was started at the first, second, or third visit after spectacle correction. We do not know if treatment had been initiated prematurely and resulted in falsely increased occlusion dose, thereby giving poorer compliance. This could have skewed the figures. So, we recommend exercising caution in interpreting the results and in concluding that time at which screening is carried out is not critical in this group.

References


Can a cilio-retinal artery influence diabetic retinopathy?

Knudsen and Lervang published an interesting article in the *BJO* recently.

The authors concluded that a cilio-retinal artery tends to worsen diabetic maculopathy but I believe there is an alternative interpretation of the data provided. The authors mentioned that 26/29 patients had a cilio-retinal artery in the eye with worse maculopathy, which was a statistically significant result. In the results section the authors did not report whether a unilateral cilio-retinal artery was present in the 75 subjects with identical maculopathy in the right and left eyes but they stated that this was true in all 75 subjects in the first sentence of the discussion. Therefore, in 75 patients the cilio-retinal artery had not caused worsening of the maculopathy compared to the contralateral eye. Taken together with the 29 subjects with asymmetrical maculopathy, the proportion of cases in whom maculopathy was *not* worsened by a cilio-retinal artery was therefore significantly more than 50%.

The authors also reported that 51 eyes had clinically significant macular oedema (CSMO) in the group of 94 subjects with maculopathy. However, the $\chi^2$ analysis should not have been performed using each eye as a case ($n=962$), as it is well known that the right and left eyes of each patient are not independent (that is, if the right eye has maculopathy, the left eye has a greater chance of having maculopathy than the contralateral eye of a non-affected eye in another patient). One possible approach would be to look at all the right eyes only or to randomly look at one of the two eyes of each subject and reduce $n$ to 481. The reader of this article will not know the outcome of this analysis without more information from the authors; however, assuming all the 51 eyes with CSMO were from different subjects, the $2 \times 2$ table may look like Table 1. This table assumes that all the 104 eyes with unilateral cilio-retinal artery and the 15 eyes from bilateral cilio-retinal cases are included, making a total of 119 subjects with cilio-retinal arteries for analysis. In the above case clearly the result is not statistically significant ($\chi^2=0.017$; $p>0.9$).

L Tong
Singapore National Eye Centre, 11, 3rd Hospital Avenue, Singapore 168751; Louistong@hotmail.com

Reference

<table>
<thead>
<tr>
<th>Table 1</th>
<th>No CSMO</th>
<th>CSMO</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cilio-retinal artery</td>
<td>324</td>
<td>38</td>
<td>362</td>
</tr>
<tr>
<td>Cilio-retinal artery</td>
<td>106</td>
<td>13</td>
<td>119</td>
</tr>
<tr>
<td>Total</td>
<td>430</td>
<td>51</td>
<td>481</td>
</tr>
</tbody>
</table>
Hospital acquired aspergillus keratitis

B Burt, G Pappas and P Simcock

Br J Ophthalmol 2003 87: 923
doi: 10.1136/bjo.87.7.923

Updated information and services can be found at:
http://bjo.bmj.com/content/87/7/923.1

These include:

References
This article cites 5 articles, 1 of which you can access for free at:
http://bjo.bmj.com/content/87/7/923.1#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/