

Recent Advances

Ophthalmology

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Advances or major changes in clinical practice can occur as a result of increased understanding of a pathological process or because of a technological advance that is then used in patient management. We concentrate on some of the recent advances or changes in management of common ophthalmic problems, some of which have become widely used without necessarily being subjected to rigorous clinical trials or knowledge of the long term sequelae.

Cataract surgery

Although phacoemulsification (ultrasound fragmentation of the lens) was pioneered in 1967 by Charles Kelman,¹ its widespread adoption as the preferred method of removing cataracts had to wait until ocular surgical techniques and intraocular lens technology caught up. Progress in cataract surgery has resulted from the combination of small, self sealing, sutureless wounds, the development of foldable intraocular lens implants, continuous curvilinear capsulorhexis (controlled circular tearing of the anterior lens capsule),² and improved techniques of phacoemulsification within the lens capsular bag. The impact of these advances has been to substantially reduce the period of visual rehabilitation after successful surgery to about one week and to rapidly accelerate the attainment of optimum visual acuity.

Cataract surgery is ideally suited to day case surgery under local anaesthetic, and most ophthalmic units now pursue this approach, often treating 90% of cases in this manner. Small incision phacoemulsification can even be performed under topical anaesthesia alone, further reducing the morbidity of intervention. Improved design of wound construction has allowed self sealing of wounds, thereby avoiding the need for sutures, which virtually abolishes surgically induced astigmatism and eliminates the need for subsequent removal of sutures. Foldable lenses made from various materials (usually silicone) can be inserted through an astigmatically neutral 3.2 mm incision, whereas rigid intraocular lens implants are manufactured from polymethylmethacrylate (PMMA) and require an incision of 5 mm or more in the sclera or cornea for introduction. The newer lens materials may have other advantages, such as a lower incidence of cell deposits on the lens surface and a lesser degree of capsular fibrosis and opacification. Small surgical incisions produce little distortion of the cornea and are less likely to leak or rupture if the cornea is traumatised.

The main disadvantage of cataract surgery by small incision phacoemulsification is the steep learning curve with its attendant rate of complications. The most notable complication is the "dropped nucleus," in which the lens nucleus or fragments fall through a tear

Summary points

- Use of self sealing, sutureless wounds; foldable intraocular lens implants; continuous curvilinear capsulorhexis; and improved techniques of phacoemulsification within the lens capsular bag in cataract surgery have substantially reduced the period of visual rehabilitation and rapidly accelerated attainment of optimum visual acuity
- Photorefractive keratectomy has been heralded as the cure for myopia, but it can have substantial side effects and not all patients respond in a predictable manner
- Injecting botulinum toxin into a muscle to produce transient neuromuscular paralysis has been used for certain types of strabismus, essential blepharospasm, induction of ptosis to protect the cornea, and, more recently, nystagmus
- New treatments for subretinal choroidal neovascularisation associated with age related macular degeneration include foveal ablation by laser photocoagulation and radiotherapy, but dietary zinc supplements, interferon alfa, and subretinal surgery have proved disappointing
- Cytomegalovirus can now be treated by implanting a device inside the eye that slowly releases ganciclovir for up to nine months, which avoids the side effects associated with systemic treatment
- Full thickness macular holes can be successfully closed by vitrectomy combined with intraocular gas tamponade

in the posterior lens capsule into the vitreous cavity; these have to be removed by vitrectomy, often by means of perfluorocarbon "heavy" liquids to float the nucleus up into the anterior chamber, from where it can be safely removed. Small incision phacoemulsification undoubtedly has higher intraoperative consumable costs than "conventional" extracapsular methods, but these are considerably offset by the reduced number of postoperative follow up visits required and the high level of patient satisfaction.

Photorefractive keratectomy

The cornea accounts for two thirds of the refractive power of the eye and can be reshaped by several surgical methods. Photorefractive keratectomy is a technique of modifying the refractive power of the

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cornea by laser ablation of the central area, thereby rendering the eye less short sighted.³ Trials of excimer laser photorefractive keratectomy for myopia started in 1989 in Germany and Britain, and later in the United States. Since then photorefractive keratectomy has been widely heralded as the cure for myopia, but it is not without substantial side effects and not all patients respond to treatment in a predictable manner. Patients who are slightly shortsighted (below -3.00 D) do well, with a 12% incidence of undercorrection of greater than 1.00 D, but those with severe myopia (greater than -6.00 D) have a 60% incidence of undercorrection. In addition, about 20% of patients lose one or more lines of Snellen vision after the procedure, and again this risk is greater for patients with more severe myopia. Other common side effects include haloes around lights, diminished night vision, and ocular tenderness.

Demand for photorefractive keratectomy is consumer led, and, since slight myopia is not a disease but essentially a cosmetic hindrance, it is extremely important that patients are given a realistic appraisal of the benefits and disadvantages of the technique before they consider embarking on this new treatment.

Botulinum toxin

Injection of botulinum toxin was first reported to be of value in managing strabismus in 1981, and since then the indications for its use in specific clinical situations have become more clearly defined. The toxin is injected directly into the chosen muscle under electromyographic control, a quick procedure that can be performed on an outpatient basis with minimal risk of systemic effects. The toxin produces a transient neuromuscular paralysis that usually starts 12-24 hours after injection, reaches maximal paralysis by 10 days, and lasts for two to three months.

The ocular indications for injection of botulinum toxin include certain types of strabismus,^{4,5} essential blepharospasm, and induction of ptosis to protect the cornea. More recently, its use in nystagmus has also been described. In patients with acquired nystagmus causing debilitating symptoms such as oscillopsia, retrobulbar injection of toxin was associated with subjective and objective improvement and reduction in the amplitude but not the frequency of the nystagmus.⁶ Latent nystagmus (nystagmus that is only apparent or is considerably worse when one or other eye is covered) is not usually symptomatic, but when it is, injection of toxin into the medial rectus allows accurate assessment of the visual potential of the beating eye and may stabilise the nystagmus since latent nystagmus is often dampened in adduction.⁷

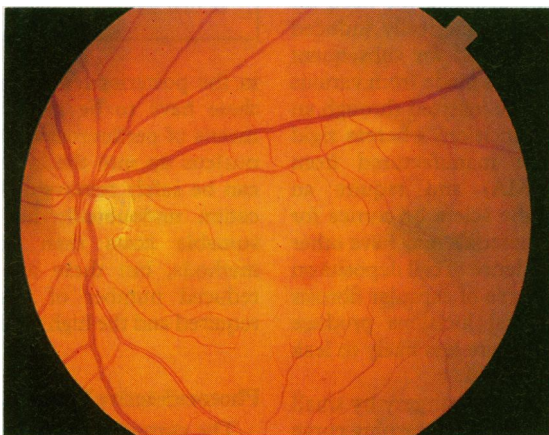


Fig 1—Fundus photograph of subfoveal and extrafoveal choroidal neovascularisation in age related macular degeneration

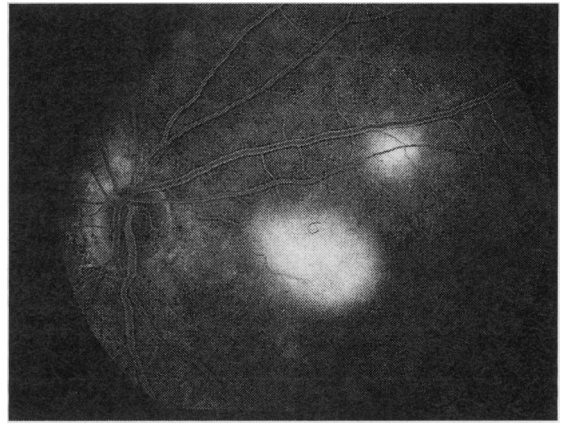


Fig 2—Fluorescein angiogram showing dye leakage (two dense white areas) corresponding to choroidal neovascular membranes

Disposable contact lenses

These were introduced in the late 1980s, predominantly for slight and moderate myopia, and were originally intended to be worn continuously for one to two weeks. They have become widely used, largely because they provide freedom from daily handling and maintenance of the lenses. However, continuous wearing of disposable lenses, or even wearing only during the day, can lead to serious complications, the most serious being corneal infection.

In the past two years disposable, single use lenses have become available at a cost not very different from that associated with wearing conventional soft contact lenses. Preliminary studies of these lenses in the United States have indicated high acceptability to users and low rates of complications.⁸ For people who can be fitted with a standard size, these lenses should be relatively trouble free, although a case of ulcerative keratitis has been reported.⁹ The risk of corneal infection will become a problem only if the instructions for the use of the lenses are not followed, as they do not come packed in sterilising solutions and should not be repeatedly handled.

More power ranges (for example, for hypermetropia, bifocal, and toric designs) will probably become available over the next few years, increasing the potential number of wearers. The concept of disposable contact lenses is not new—they have been used for some years as bandage lenses when medically indicated for problems with the ocular surface.¹⁰

Age related macular degeneration

Patients with age related macular degeneration who have subretinal choroidal neovascularisation (figs 1 and 2) generally have a poor visual prognosis.¹¹ Recently, several new treatments have been introduced, including foveal ablation by laser photocoagulation,¹² supplementation of dietary zinc,¹³ interferon alfa,¹⁴ radiotherapy,¹⁵ and subretinal surgery.¹⁶

Laser photocoagulation—The use of laser to treat subfoveal choroidal neovascularisation may reduce the eventual size of the central scotoma.¹² However, it is associated with an immediate drop in Snellen acuity of about three lines, which may be difficult for a patient to accept in the better eye since the condition is often bilateral.

Dietary zinc supplements were given in the hope that zinc dependent enzymatic pathways in the retinal pigment epithelium would be enhanced and increase the removal of phagocytosed photoreceptor debris. However, the initial optimism was not realised by long term clinical trials.

Interferon alfa administered by subcutaneous

injection was initially reported to be helpful,¹⁴ but a recent trial did not find any important benefit (A C Bird, personal communication).

Radiotherapy—A pilot study of low dose radiotherapy to the macular region in patients with expanding subfoveal choroidal neovascularisation has recently reported encouraging results. Experimental studies had shown that neovascular complexes in healing ocular wounds were significantly inhibited by doses of γ radiation greater than 9.5 Gy.¹⁷ Since the risk of radiation retinopathy is low if eyes are exposed to less than 25 Gy, a dose of 10-15 Gy of 6 MV photons was selected and applied to the posterior pole of the eye. At six and 12 months after treatment, 78% and 63% respectively of treated patients had maintained or improved their visual acuity with reduction in size of the choroidal neovascularisation, whereas visual acuity had slowly deteriorated in the untreated control patients. A multicentre trial is now in progress to further assess this treatment.

Surgery—Surgery for age related macular degeneration has proved to be of little value in enhancing visual recovery, although individual patients may benefit by stabilisation of visual acuity, lessening of distortion, and reduction in size of scotomas. The two main techniques used are surgical removal of subfoveal choroidal neovascularisation through a small retinal incision¹⁷ and transplantation of retinal pigment epithelium cells.¹⁸ Surgical removal of neovascularisation has proved more successful in improving vision in younger patients with choroidal neovascularisation secondary to inflammatory disorders affecting the choroid than in age related macular degeneration, where there is often considerable damage to photoreceptors and the retinal pigment epithelium. Cultured cells of fetal retinal pigment epithelium have been transplanted as a monolayer patch into the subretinal space, but so far this has achieved only a modest and transient improvement in visual function. Since atrophic age related macular degeneration is an increasingly common problem with enhanced longevity, transplantation may offer the greater promise in overcoming this major cause of blindness.

Inherited retinal dystrophies

These disorders are genetically determined and differ from each other in their mode of inheritance, pattern of visual loss, and clinical appearance on

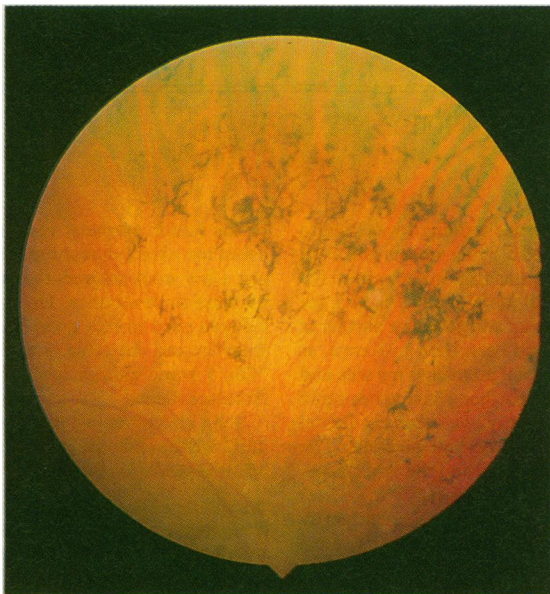


Fig 3—Fundus photograph showing typical pigmentary disturbance in peripheral retina in retinitis pigmentosa



Fig 4—Fundus photograph showing full thickness macular hole with surrounding cuff of subretinal fluid

ophthalmoscopy. They can be divided into broad groups depending on their clinical features, and the largest number fall into the category of retinitis pigmentosa (fig 3). Many mutations have been detected in the rhodopsin gene,¹⁹ and this gene seems to account for about 30% of cases of autosomal dominant retinitis pigmentosa. Most mutations seem to be specific to a particular family, but some have been found in different parts of the world, which may still reflect a large pedigree. Abnormalities in other genes have also been implicated in retinitis pigmentosa, including one in the gene for peripherin,²⁰ a glycoprotein thought to be essential for normal outer segment discs of the retinal photoreceptors. Mutations in the gene coding for the β subunit of phosphodiesterase have been recorded in patients with autosomal recessive retinitis pigmentosa.²¹

Although such genetic findings have not yet provided a treatment for these diseases, counselling of patients and relatives is much more accurate if the genomic abnormality is known. The distribution of the abnormal gene can be mapped in a family, and the genetic status of an individual can be identified at any stage of the disease, which is otherwise not always possible and which is particularly important in X linked diseases.

Intraocular slow release drug devices

Cytomegalovirus is the commonest cause of retinitis in patients with AIDS, and once it has occurred lifelong antiviral treatment is necessary as current drugs are virustatic rather than virucidal. Ganciclovir is the most commonly used drug and can be given systemically (in which case it can cause many side effects) or by injection into the vitreous cavity of the eye. Intraocular injections need to be repeated frequently to control the disease, but this can now be avoided by implanting a device inside the eye that slowly releases ganciclovir for up to nine months.^{22 23} When it is exhausted the implant can be replaced with another, and only low rates of infection and retinal detachment have been reported.²⁴ The implant, however, gives no protection to the second eye, so patients need careful monitoring, with the addition of systemic treatment when necessary.

Macular hole surgery

The unique anatomical structure of the fovea predisposes to the development of localised retinal holes at the macula (fig 4), most commonly in women in their 70s. This leads to impaired visual acuity, which is often made worse by the presence of a cuff of subretinal fluid around the hole. Until recently, these full thickness macular holes were considered essentially untreatable, and attention was devoted to

treating impending macular holes by vitrectomy in the hope of preventing or minimising loss of central vision. Unfortunately, randomised controlled studies have failed to show any significant benefit of surgery for impending holes.²⁵

However, vitrectomy combined with intraocular gas tamponade, particularly with long acting gases such as perfluoropropane (C₃F₈), can successfully close established age related or traumatic macular holes and result in significant visual improvement. Glaser and coworkers have pioneered the use of recombinant transforming growth factor-β to enhance closure of the hole,²⁶ but autologous serum,²⁷ plasma,²⁸ and platelet rich plasma may be equally effective and considerably less expensive. Patient selection is important for two reasons: long standing holes (> 6 months' duration) do not do well, and a face down posture is crucial during the postoperative period—usually for several weeks—until the gas bubble is reabsorbed. Vitrectomy with gas tamponade has complications: one recent series recorded a 14% incidence of retinal detachment from peripheral retinal breaks—a rate of about 5% might normally be expected—and an increased risk of cataract development from the long acting intraocular gases.²⁹

The ability to separate the posterior vitreous face from the retina and create an iatrogenic posterior vitreous detachment in other clinical situations has aroused considerable interest. The spontaneous development of a posterior vitreous detachment may be associated with the development of retinal holes at the macula or, more commonly, in the more peripheral retina, which can lead to rhegmatogenous retinal detachment. Retinal neovascularisation (for example, in proliferative diabetic retinopathy or after retinal vein occlusion) requires the presence of an attached vitreous gel as a scaffold for the new vessels and is virtually abolished in the presence of a posterior vitreous detachment. Intravitreal injection of an expanding gas has been used to create a posterior vitreous detachment with subsequent closure of 13 out of 17 early macular holes and without important side effects.³⁰ Although no retinal detachments occurred in this small series, it is unlikely that the technique will be completely free from this serious complication.

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A PRACTICE THAT CHANGED MY LIFE

Not suitable

Having finished my general practice training I was keen to find a suitable practice. I applied for many posts and even got a few interviews, but I never managed to get beyond the initial interview, until the fateful job was advertised. I got on well with the middle aged get up and go senior partner at the informal look round. She had been born in Kenya, as had I. After a couple of more formal interviews my wife and I were invited to dinner with the partners, having been told that they were now considering only one other candidate. They were, as expected, middle class and pleasant. The senior partner was from the old school and the other three, all in their 30s, were somewhat in awe of her.

Dinner progressed from small talk with the starters to some intelligent, in depth discussions with the main course and wine. There were only hints of what was to come. Finally, with the dessert everyone relaxed until one

of the junior partners, realising that time had flown by, asked me what I thought made a "good GP." I stammered out a few stock answers to which he listened. Then it was his time to pronounce. He started: "I think to be a good GP you need to be a good Christian." Nods of agreement from around the table. I could not let it go and replied: "Oh, I know quite a few good GPs who are Muslims." Absolute silence.

Soon afterwards we made our hurried excuses and left, and I went to join the RAF.—DAVID ARATHOON is a medical officer in the Royal Air Force

We welcome filler articles of up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk.