DEJ
DiabeticEye Journal

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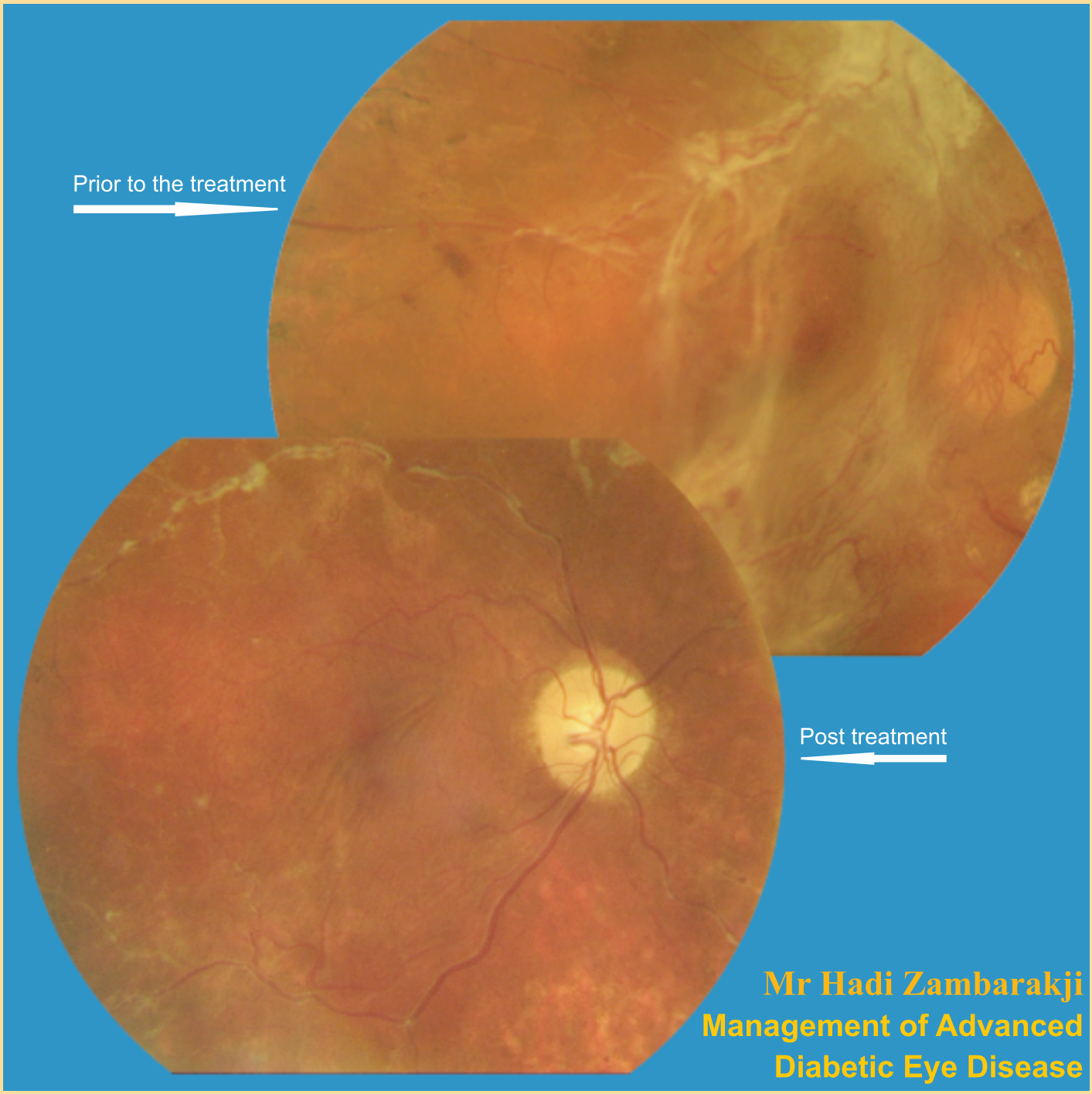
Diabetes UK Focusing on Children and Footcare Campaign in 2014



Mr Hadi Zambarakji
Management of Advanced Diabetic Eye Disease

Spotlight on DESP: NMUH Diabetic Eye Screening for North Central London

Medical Paper: Use of Furosemide for Diabetic Macular Oedema in Pregnancy

Other lesions: Ms Bola Odufuva on Glaucoma

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DiabeticEyeJournal

EDITORIAL

After our very successful launch of DEJ last September at British Association of Retinal Screening (bars) Conference we are now into its second issue. We were very encouraged by your positive feedback, which indicated that the Journal is moving in the right direction.

Our main columns will include:
Diabetic Eye Disease
Other Lesions
Diabetes UK
Update from NDESP
and **Spotlight on DESP**, which will introduce one Screening Programme from around the country in every issue of DEJ. This would be the platform for you to share your experience, projects, findings and ideas. So come and get involved, and email us your proposals to ***info@diabeticeyejournal.org***

DEJ is in its infancy, and part of its evolution was to establish recognised publishers, which we can proudly confirm is the British Association of Retinal Screening. We will be distributing DEJ to all DES Programmes and major HES and you can also follow us on our website ***www.diabeticeyejournal.org***. The Journal will be coming out every six months - March and September - and we will be promoting it at a major Eye and Diabetes related conferences. We are delighted to present this second issue and look forward to your feedback and comments.

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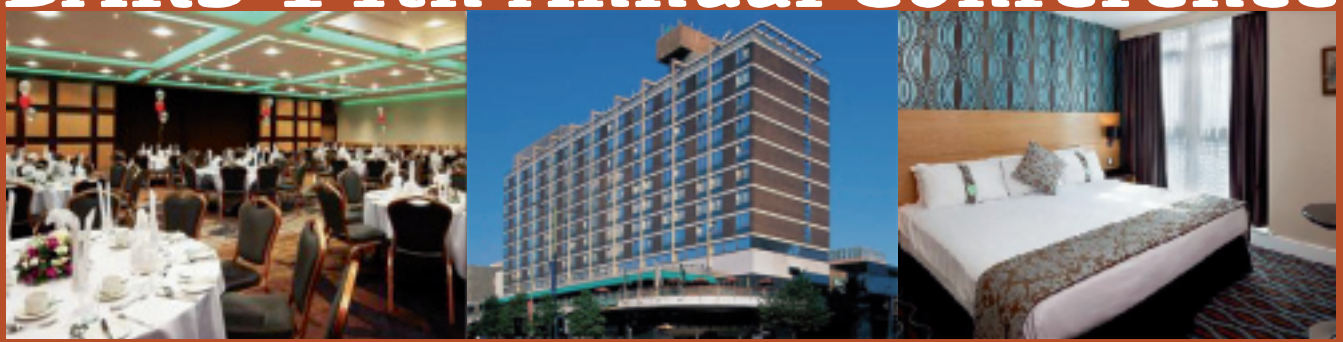
'When do we operate for diabetic retinopathy?'

Mr John Brazier - Cataract operation and DR complications

Mr Kevin Shotliff - Oral glucose lowering agents in diabetes mellitus

info@diabeticeyejournal.org

BARS 14th Annual Conference



BARS Council are pleased to announce the 14th Annual BARS Conference, which will be held on 25th and 26th of September 2014 in the centre of Birmingham at Holiday Inn hotel.

For the provisional programme, registration and accommodation details see the resources section on the BARS website: ***www.eyescreening.org.uk***

DiabeticEyeJournal is published and produced by BARS with support of North Central London Diabetic Eye Screening Programme from NMUH NHS Trust.

Courses

Two day Seminar: The Royal College of Ophthalmologists

13 CPD points, relevance: Ophthalmology specialties
Topic: Skills in Retinal Imaging, Diagnosis & Therapy
19th Jun 2014, London

To register: *events@rcophth.ac.uk*

CPD course in Diabetic Eye Disease

City University London
Two day course running 28th - 29th April 2014

http://www.city.ac.uk/courses/cpd/diabetic-eye-disease#course-detail=0

Training Courses at Retinopathy Screening Centre, Heartlands Hospital, Birmingham

DR Grader Course: 7 to 11 April 2014
Clinical Lead Programme: 7 to 8 May 2014
Advanced DR Grader Course: 22 to 24 September
DR Grader Course: 29 September to 3 October

http://www.retinalscreening.co.uk

Diabetes UK – Diabetes Awareness Training

Various dates and in-house training available.
One-day course to provide participants with the knowledge and confidence when working with people with diabetes, accredited by the Royal College of Nursing (RCN)
Phone: 020 7424 1000

Contact enquiry: *commissioning@diabetes.org.uk*

Conferences

Ethnicity and diabetes

Monday 14 April 2014
Venue: Royal Society Of Medicine, 1 Wimpole Street, LONDON, W1G 0AE

To register: *http://www.rsm.ac.uk/diar/diary.php*

National diabetic eye screening conference 2014

Programme: Integration - where do I fit in?
Wednesday 30 April 2014
Venue: Royal Society Of Medicine, 1 Wimpole Street, LONDON, W1G 0AE

To register: *http://www.rsm.ac.uk/diar/diary.php*

The 24th EASDec 2014 conference

Eye Complications Study Group (EASDec)
15th - 17th May 2014, Padova, Italy

To register: *http://easdec.org/pages/*

The 50th EASD Annual Meeting

Topics: Understanding of Diabetes Mellitus
Relevance: Diabetes related specialties
15 - 19 September 2014, Vienna, Austria

To register: *abstracts@easd.org*

14th Annual BARS Conference

Birmingham Holiday Inn
25th and 26th September 2014

To register: *http://www.eyescreening.org.uk*

Management of Advanced Diabetic Eye Disease

by **Mr Hadi Zambarakji**

FRCOphth D.M. Consultant Vitreoretinal Surgeon

Barts Health, Whipps Cross University Hospital

Diabetic retinopathy remains the commonest preventable cause of blindness in the working age population in the industrialised world. A review of UK blind and partial-sighted registration between April 1999 and March 2000 showed that diabetic retinopathy accounted for 5.9% and 7.4% respectively of sight impairment registration.[1] In this article, I will discuss the management of complications of proliferative diabetic retinopathy (PDR).

Improved control of blood glucose, blood pressure and cholesterol reduce the risk of development and progression of diabetic retinopathy, and for those who develop PDR, panretinal laser photocoagulation (PRP) remains the first line therapy. Despite this, at least 4.5% of eyes will still develop complications, which require surgical intervention.[2]

The principal indications for surgery are non-clearing vitreous haemorrhage and retinal detachment (either tractional (TRD), rhegmatogenous (RRD) or combined tractional/rhegmatogenous (CTRD)).[3] Less common indications for surgery include recurrent vitreous haemorrhage, TRD threatening the macula, uncontrolled new vessels, rubeosis and vitreous haemorrhage, premacular haemorrhage, vitreomacular traction (VMT) in the presence of a taut thickened posterior hyaloid (TTPH), ghost cell glaucoma, neovascular glaucoma and proliferation of the anterior hyaloid.

Removal of the vitreous appears to have a stabilising influence in PDR. It is likely that several factors contribute to this effect. Firstly, attached vitreous gel acts as a scaffold for fibrovascular proliferation and removing it hinders reproliferation and reduces the tractional forces, which traumatise the fragile new vessels causing haemorrhage. Secondly, the relief of traction on retinal blood vessels may improve their perfusion and reduce leakage. Thirdly, removing the vitreous may increase oxygen supply to the inner retina and prevent accumulation of vasoactive cytokines by allowing unrestricted circulation of fluid in the vitreous cavity.

Diabetic Vitreous Haemorrhage

It is over 20 years since the Diabetic Retinopathy Vitrectomy Study (DRVS) showed a clear benefit to early pars plana vitrectomy (PPV) in patients with type I diabetes and those with uncontrolled neovascularisation. Since the DRVS, there has been a trend toward lower thresholds for vitrectomy in diabetic vitreous haemorrhage. This has been prompted by improvements in the safety of surgery, cost-effectiveness, and a growing body of evidence to suggest a benefit to visual outcome for type I and type II diabetes.

In our experience, patients seen in the vitreoretinal unit were often managed with intensive PRP laser by their medical retina specialist. We would therefore have a low threshold to offering vitrectomy surgery at the time of first presentation in the presence of non-clearing vitreous haemorrhage.

Important considerations include retinopathy status and visual acuity in the fellow eye as well as patient preference. Visual outcomes however, may be limited by macular oedema and/or macular ischaemia (in the absence of vitreomacular traction or TRD involving the macula).

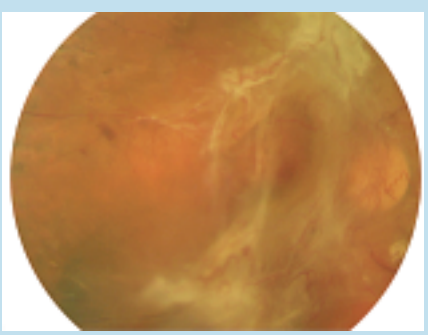
Retinal Detachement

Retinal detachement **(figure 1)** remains the commonest indication for vitrectomy in PDR accounting for almost half the surgical cases compared with 43% for non-clearing vitreous haemorrhage.[3] The timing of surgery is strongly influenced by the aetiology of the detachment and the proximity to the macula.

TRD arises from progressive fibrovascular proliferation and contraction. The detached retina typically has a concave appearance with limited mobility and the condition is characterised by slow progression. Urgent surgery is rarely required except in the context of visual loss associated with rapid progression of traction and macular involvement.

Extra-macular TRD can usually be managed conservatively, though there is a trend towards earlier surgery as the detachment approaches the macula due to the poor prognosis once the macula is affected.

In contrast to the indolent course of most TRD, the fibrosis and contraction may be sufficient to cause a localised break in the retina resulting in CTRD. In this situation the detachment may progress rapidly and is typified by a convex appearance and greater mobility of the retina. Urgent surgery is required in this situation. CTRD can be challenging, as removal of all membranes may prove difficult in the presence of mobile retina.



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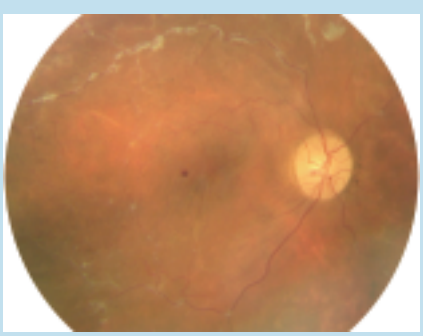


1(b)

Figure 1

Traction retinal detachment with extensive fibrovascular proliferation **(a)** in the right eye of a 28-year-old insulin dependent diabetic patient. Visual acuity at the time of presentation was 6/60.

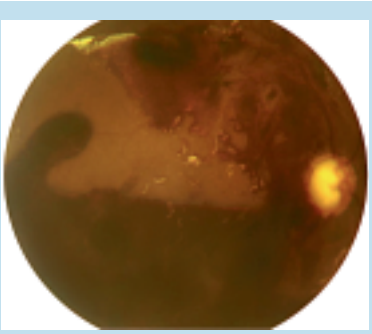
Retinal photograph one year after vitrectomy and membrane delamination shows a fully attached retina, and along the blood vessels signs of the previously delaminated membranes **(b)**. The visual acuity improved to 6/18.

Pre-Macular Haemorrhage

The presence of extensive pre-macular haemorrhage **(figure 2)** is a further indication for early vitrectomy, with studies suggesting that blood trapped against the retina may cause toxic damage, exert traction on photoreceptors and form a physical barrier to diffusion of nutrients and metabolites. Furthermore, the presence of pre-retinal haemorrhage suggests an attached hyaloid face, which may promote vascular proliferation, recurrent haemorrhage and macular oedema.

Figure 2

Dense acute pre macular haemorrhage **(a)** in the right eye of a 51-year-old diabetic patient with co-existent advanced glaucoma. Visual acuity at presentation was CF. The patient underwent vitrectomy with separation of the posterior hyaloid with a good outcome. Visual acuity improved to a level of 6/12 post-operatively **(b)**.



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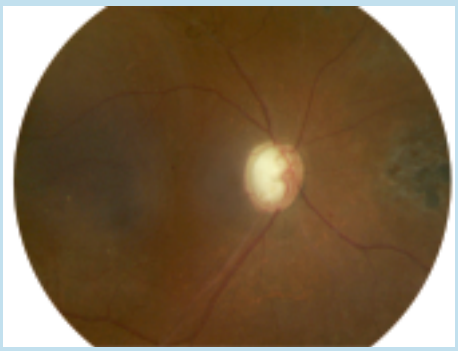

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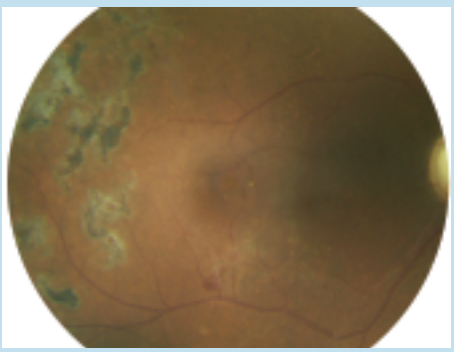


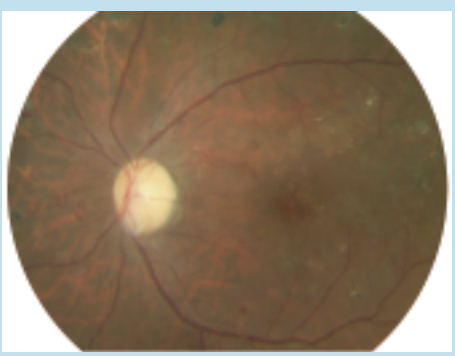
2(b2)

Vitreomacular traction (VMT) and taut thickened posterior hyaloid (TTPH)

The benefits of focal or modified grid laser photocoagulation for clinically significant diabetic macular oedema (DMO) were established by a number of studies. In recent years, the benefits of inhibitors of vascular endothelial growth factor (VEGF) over laser were clearly demonstrated.

When considering the role for vitrectomy in the treatment of diffuse DMO refractory to laser therapy, the attachment of the posterior hyaloid is a critical observation. It is generally agreed that the presence of traction is an indication for vitrectomy, with efficacy demonstrated in both vitreomacular traction (VMT), and in the presence of a taut thickened posterior hyaloid (TTPH) **(figure 3)**.[4] However, the role for vitrectomy in the absence of demonstrable traction remains unclear.

3(a)



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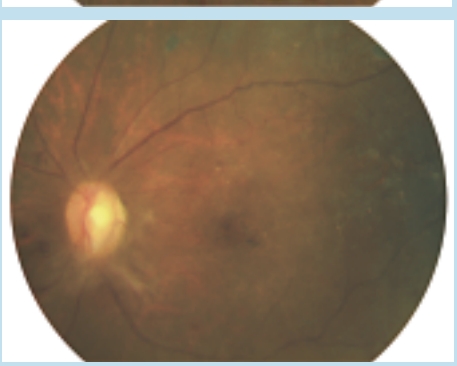

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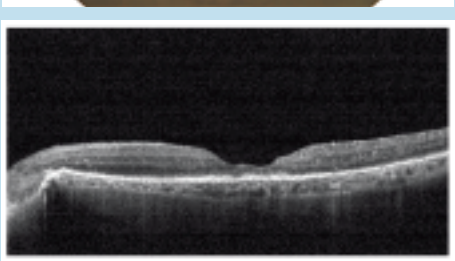

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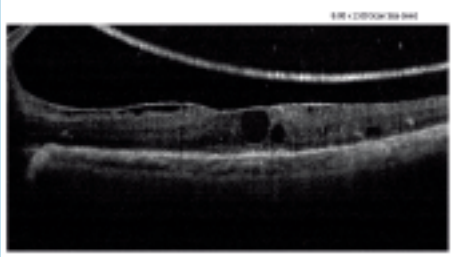

Figure 3

A taut and thickened posterior hyaloid with epiretinal membrane **(a)** and some macular cystoid changes noted on the pre op OCT scan **(c2)** in an eye with treated proliferative diabetic retinopathy. Retinal photograph following vitrectomy and separation of the posterior hyaloid with membrane peeling is shown **(b)**. The post-operative OCT **(c1)** shows an improved macular profile. Visual improvement was maintained through 3 years of follow up, but was limited to one Snellen line, and could be explained by the long standing macular traction and thinned out outer retina.

Pharmacological Adjuvants in Vitrectomy Surgery

The use of anti-VEGF adjuvant drugs (bevacizumab and ranibizumab) in diabetic vitrectomy is primarily targeted at reducing the risk of intraoperative and postoperative haemorrhage in the setting of active retinal neovascularisation or in the presence of very vascular fibrous fronds with TRD. Bevacizumab given 2-7 days pre-operatively by intravitreal injection, has also been shown to reduce operating time, creates a cleavage plane for dissection of membranes with anecdotal reports that fibrovascular membranes become less adherent. The role of top-up intravitreal bevacizumab at the end of surgery remains unclear.

There is however, a potential risk of causing progression of TRD following intravitreal bevacizumab, therefore surgery should not be delayed once an anti-VEGF has been given in this context.

Diabetic Vitrectomy, Lens Status and Phacoemulsification

Many patients who undergo PPV will either have pre-existing lens opacity or develop lens opacity after surgery. However, Holekamp et.al. have suggested that relative retinal ischaemia and lower oxygen tension in the anterior vitreous in diabetic retinopathy may reduce rates of cataract progression.[5]

Combining vitrectomy with phacoemulsification and lens implantation offers several potential benefits. Intra-operatively, the removal of an opacified lens can improve visualisation of the posterior segment and allow more complete vitrectomy without the risk of lens touch. Postoperatively the improved view can aid assessment of the posterior segment and make laser easier. For the patient, removal of lens opacity can improve postoperative acuity and avoid the need for cataract surgery at a later date. However, combined surgery may have disadvantages including; longer operating time, corneal oedema impairing the surgical view, increased levels of anterior segment inflammation and the risk of posterior synechiae.

Choice of Vitrectomy Gauge

Small gauge vitrectomy has become increasingly popular in recent years and it is clear that the quality of the new generation instruments has improved dramatically such as almost every vitrectomy procedure can now be performed using small gauge instruments. Advocates of 25G and 23G systems point to reduced surgical time, improved fluidics, reduced patient discomfort and more rapid visual recovery. However, incidence of sclerotomy-related complications such as hypotony, and an increased rate of endopthalmitis may be disadvantages compared with standard 20G surgery.

For diabetic vitreous haemorrhage, I would usually perform 23G PPV but I prefer the use of standard 20G instrumentation for complex TRD or CTRD and for cases requiring lensectomy or if peripheral dissection of membranes may be necessary. Whilst the 25G and 23G systems may offer a particular advantage in the removal of membranes, where the design of the ocutome cutting port is such that it sits 50% closer to the tip of the probe than in the 20G system, the need for curved scissors for performing dissection of membranes in some cases may limit the use of small gauge instruments.

Patient follow-up

Patients with advanced PDR often have bilateral disease and tend to be of a working age group. They usually have poor diabetic control and multiple complications of diabetes, thus often will be seeing several hospital specialists (diabetologist, podiatrist, nutritionist etc…). It is therefore quite important that they are not discharged if they miss a clinic appointment. When patients are lost to follow up, they may only represent when the vision is affected and the retinopathy has got worse. Regular follow-ups are therefore quite important.

Conclusions

Despite advances in surgical technique, instrumentation and adjuvant pharmacotherapy, it is important to remember that the principal determinant of postoperative visual acuity is retinal function. As proliferative diabetic retinopathy is associated with retinal ischaemia, visual outcome may be limited despite apparent anatomical success after surgery. Improvements in the safety and outcome of vitrectomy have reduced the thresholds for surgery, and are reflected in a trend towards earlier surgical intervention in diabetic retinopathy.

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5. Holekamp NM, Shui YB, Beebe D. Lower intraocular oxygen tension in diabetic patients: possible contribution to decreased incidence of nuclear sclerotic cataract. *Am J Ophthalmol* 2006;141(6):1027-1032

Hadi will be running a **Special Interest Symposium** (SIS) on ***myopic macular disease*** at **EVER** (European association for Vision and Eye Research) on Saturday **4th of October.**

If you'd like to find out more about this topic:
The meeting dates are from **1st to 4th October 2014** and symposium is provisionally scheduled for Saturday the 4th.

This year's **EVER** congress is in the beautiful city of Nice in the South of France.

Abstract submission deadline is 26th of May.
To register and find out more visit:

http://www.ever.be/news.php

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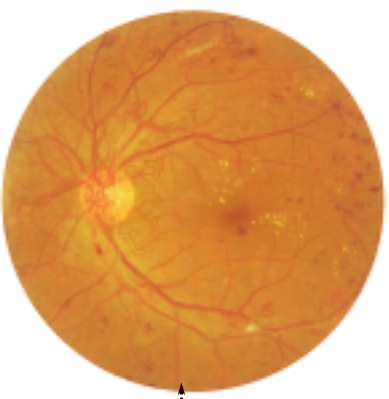
NHS North Central London

NMUH Diabetic Eye Screening for North Central London

North Middlesex University Hospital NHS Trust

WORKING TOGETHER TOWARDS REDUCING BLINDNESS FROM DIABETIC EYE DISEASE

GP referral of patient with diabetes to the local Diabetic Eye Screening (DES).
Diabetic Retinopathy (DR) can go unnoticed, damaging the eyes without any symptoms.



DIABETIC RETINAL EYE DISEASE

At the **Annual DES** appointment the retina of the eyes is photographed to expose any signs of DR before it becomes sight threatening.

Treatment and Managenent of advanced stage DR by Laser, which is administered by Consultant Ophthalmologist at the Eye Clinic.

NCL DESP NMUH NHS Trust
Sterling Way, London N18 1QX
tel: 020 8887 2352
email: ncl.desp@nhs.net

Spotlight on Diabetic Eye Screening Programme

North Central London Diabetic Eye Screening Programme run by North Middlesex Univercity Hospital NHS Trust

Our Programme

North Middlesex University Hospital (NMUH) NHS Trust has been providing the Diabetic Eye Screening (DES) Service to the population of Enfield and Haringey for over 20 years. It was started by Dr Hilary Tindal (Diabetologist at NMUH) and Dr Stephen Corcoran (local GP). They both recognised that there was a need for systematic and regular eye examination of diabetic patients to identify those with screen positive Diabetic Retinopathy.

To start with a patient database was set-up on a laptop computer, rolls of film and a fundus SLR were used to acquire retinal images and feature based grading forms were used to grade patients. Grading itself was done by clinicians who examined the projection of the processed slide films in a dark environment on the screen. At this time DES team consisted only of a handful of committed pioneers including orthoptist Jacqueline Mansell, who later shared her knowledge and experience with the wider screening comunity as a Chairman of British Association of Retinal Screening (BARS).

The database grew and eventually reached 12 000 diabetic patients and extra optometrists were taken on to facilitate the demand for Diabetic Eye Screening (DES). Screening was running twice a week with 15 patients booked in each session, and extra being brought in by Diabetologists on ad hoc basis. A slit lamp clinic would run alongside the screening clinic, so patients with referable disease would be referred straight away to the eye unit, while patients with no disease or minor retinopathy would receive their result letters in about 2 weeks.

With advancements in technology, diabetic eye screening became faster so it was easier to cope with the growing demand for the service. Digital cameras were introduced in 2001 and collaboration with Digital Healthcare began on a software that was piloted at the NMUH. This resulted in much chaos at the time but eventually Optomize has become the national software choice.

In 2008 Enfield and Haringey DES Programme sucessfully passed their first EQA visit. Unfortunately this was not the case for neighbouring Camden and Islington DESP in 2009, and NMUH was comissioned to step in and launched a combined service for the patients of all 4 boroughs.

With gradual changes in London's PCTs strucutre, Enfield, Haringey, Camden, Islington and Barnet were merged into the new North Central London group, and a tender process was set in motion to run the retinal screening for all 5 boroughs. NMUH secured this contract and relaunched the combined North Central London (NCL) DESP in 2012.

Susanne Althauser is the inspiring Clinical Lead and the January 2014 EQA visit to the combined scheme has had excellent reviews.

Our Team

NCL DESP is the fourth largest screening programme in the country and the largest programme in the greater London employing **41 permanent members of staff** from a great variety of backgrounds, cultures & languages reflecting the tapestry of North Central London.

Provision of DESP for North Central London

We have a Programme Manager, Clinical Lead & Support Manager. It is divided into 3 departments. The Admin Dept organise & change all the appointments, The Screening Dept take & assess the photographs & refer patients to the hospital for further assessment and treatment & The Failsafe Dept stop things from going wrong, Our Training Manager ensures that all the staff have the right skills for their roles & our GP Clinical Lead helps the programme to work effectively with the 250 General Practices where our patients are registered.

Programme is providing service to over **67,000 diabetic patients** at 13 fix clinic locations including seven hospitals and six community centers. Referable disease is referred to five local Hospital Eye Services.

Staff have different responsibilities within the teams such as camera maintenance, ensuring pregnant women receive timely appointments, responsibility for OPDR & SLBM & ordering & distributing supplies to our clinics. There is a scope to run various audits, design posters and leaflets, and be involved in Diabetes and Eye Health related events.

Flexible working hours help us to offer a vital out of hours telephone service & clinics (early mornings, evenings & Saturdays).

NCL DESP provides the entire process of screening and grading in-house. This includes call & recall, screening, provision of Slit Lamp Biomicroscopy, OPDR, grading, and fail-safe.

The NCL DESP provided by North Middlesex Hospital had its **External Quality Assurance** visit on the 23 January 2014 resulting in very positive outcome and feedback, and our motto is to provide diabetic patients with service centered around their needs without compromising on quality.

This feature was contributed to and composed by NCL DESP Programme manager Ali Askari, Screening manager Elisabeth Murray, Dr Stephen Corcoran and Senior Screener/Grader Sandra Reveira.

Our Work

Going Extra Mile: Audit of Whittington Drop-in Clinic

Iveta Olejkova - Senior Screener/Grader NCL DESP NMUH NHS Trust

In the first issue of this Journal our programme introduced the DES drop-in clinic at Whittington Hospital. This idea sprung out of demand for eye screening for the patients from diabetic clinics. Our programme has been using the screening room at our hospital site also as a grading room. The screener/grader would check patients who arrived for diabetes appointments against our database and offer those who were DNAs, Lost to Follow/Up, or due for Screening in a near future an appointment during the same visit.

The majority of patients welcomed this option. We called it 'one stop appointment shop'. This we found reduced the DNA rate, promoted integrated care, and strengthened the relationship with the Diabetic department. But most importantly it picked-up on serious diabetic eye disease in patients who weren't attending their eye screening for a very long time.

The summary of our audit for the period from February to November 2013

The Drop-in clinic is without any pre-booked appointments. It is available to patients attending hospital for the Diabetes related clinics. We run it on a busiest day for diabetes department to maximise the uptake, and fill the spare time with grading. In a space of 10 months we have screened **215** patients:

Grade	Amount
R3	021
R2, M1	045
R1, R0, M0	149

Legend:
L to F/U lost to follow up
ICO in care of ophthalmology
DNA non attendees

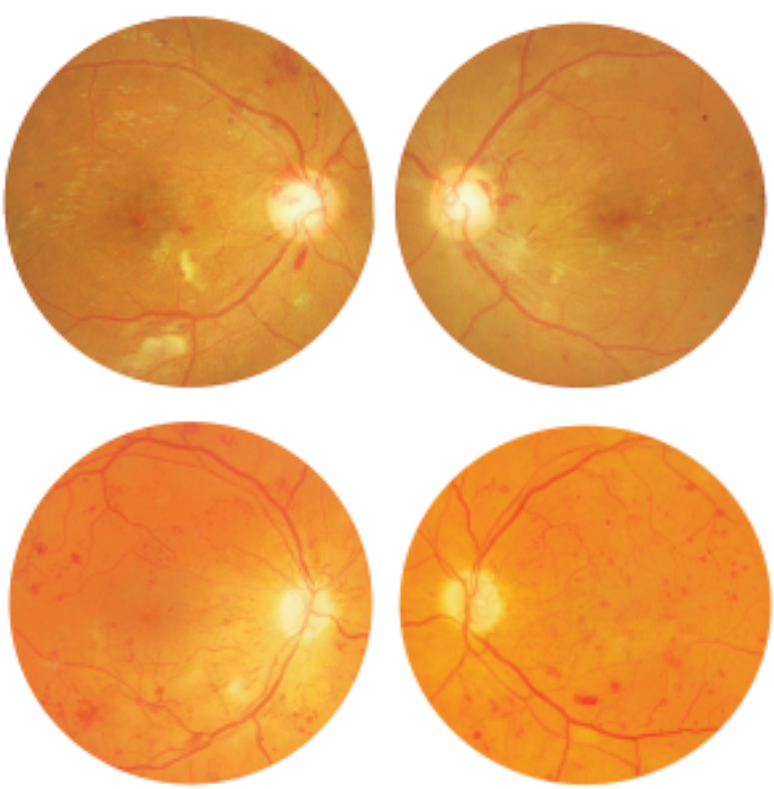
Age	R3	R2, M1
20 - 45	06	12
46 - 65	08	17
66 - 89	07	16

R3	Amount
DNA DES or ICO	12
in ICO	05
L to F/U	03
Attendees/Other	01

R2	Amount
DNA DES or ICO	22
in ICO	05
L to F/U	08
Attendees/Other	10

R1, R0, M0	Amount
DNA in past	35
DNA in 2013	37
Attendees/Other	77

Drop-in clinic managed to pick up considerable number of patients with pre and proliferative DR, of whom many were DNAs. Since then all were referred into Ophthalmology and some received a treatment.



Examples

Nephrology clinic:

25 year old male screened first time in 2007: R1M0 and VA 6/6 BE

DNA from 2008 to 2013, then dropped-in from Nephrology clinic in July 2013: **Figure 1**

Result: R3M1, VA 6/9 BE

Since then undergoing treatment in ICO and diagnosed with Glaucoma.

Diabetes/Foot clinic:

46 year old female screened first time in May 2013 after being approached by screener/grader while visiting foot clinic: **Figure 2**

Patient DNA for the past 5 years.

VA 6/9 with R3M1 in BE

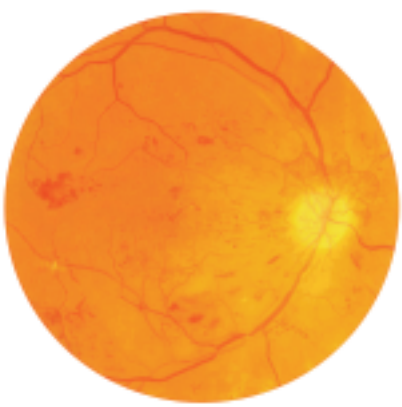
Since then undergoing treatment in ICO.

Conclusion to Type 2 Diabetic Patient Case Study introduced in first issue of DEJ in September 2013:

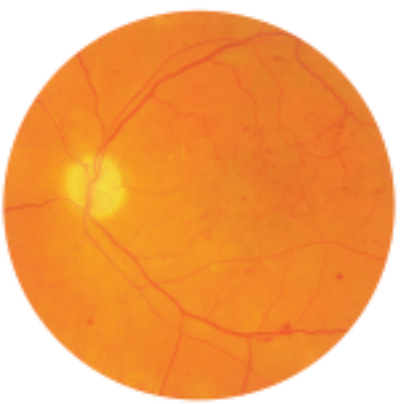
The study case that we introduced in our first issue was a 46 years old type 2 diabetic patient, who wasn't able to attend their DES due to complex health and personal problems and was picked-up by the drop-in clinic. The patient is continuing with planned treatment since May 2013 and here is its summary.

Miss Susanne Althauser - Consultant Ophthalmologist Royal Free Hospital and Clinical Lead NCL DESP NMUH

As discussed in the first issue of DEJ, the patient had in her first three months, after being referred into ICO, PRP laser treatment in both eyes for her proliferative diabetic retinopathy and in the left eye three anti-VEGF injections for macular oedema. The right eye had no macular oedema at that stage. On treatment, her new disc vessels regressed rapidly in the left eye, helped by the Anti-VEGF injections, but kept progressing in the right eye. Her visual acuity was relatively stable with 6/12 in both eyes.



October 2013 RE



October 2013 LE

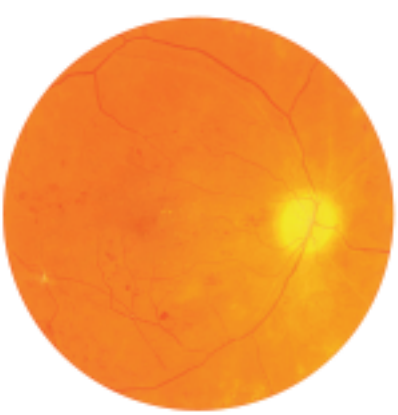
During the following six months she developed Rubeosis and cystoid macular oedema in the right eye and was started on a course of Anti-VEGF injections to the RE. The new disc vessels and the Rubeosis regressed rapidly after the Anti-VEGF in the right, her macular oedema is improving and her last central subfield thickness was 290 microns in the right. Her left macular oedema is regressing but she has still a central subfield thickness in the LE of 470 microns, initially it was 670 microns. At present there is no active NVD, NVE or Rubeosis in either eye but bilateral cystoid macular oedema persists and the patient is on continuing ongoing Anti-VEGF treatment. Her Visual acuity is so far stable and fluctuates between 6/ 9 and 6/12.

Summary of Treatment over last 9 months:

PRP Laser: RE 2200, LE 2400. Anti VEGF injections: RE three injections, LE six injections.

Future risk:

The main risk is the macular oedema which might not regress with Anti-VEGF treatment and which could lead to a permanent reduction in the visual acuity. The second important risk is recurrence of NVD/NVE and Rubeosis with vitreous haemorrhage and risk of rubeotic glaucoma and retinal detachment.



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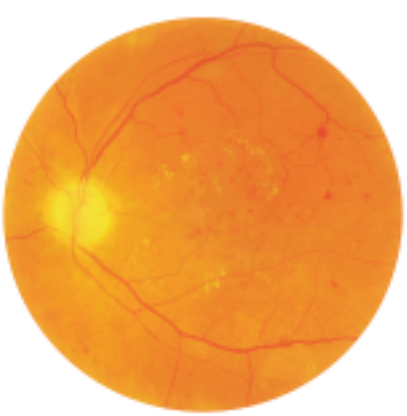

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Glaucoma, its types, screening, and treatment

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Glaucoma is a disease that causes visual field defects with characteristic changes in the optic nerve head (optic disc) typically with raised intra ocular (eye) pressure.

In the normal eye a fluid called aqueous humor is produced in a specialised area at the root of the iris (ciliary body). It is a clear watery fluid and its function is to carry nutrients to the tissues at the front of the eye. After it has done its job it drains out through a small canal and back into the bloodstream. The rate of fluid production and drainage is carefully balanced so that the pressure of the fluid is kept within certain limits. In glaucoma this balance is disturbed and the pressure in the eye begins to increase. The tissues in the eye particularly the blood vessels and the nerve fibres that carries vision to the brain become compromised when the pressure in the eye is higher than can be tolerated. If this situation is allowed to continue untreated then gradually the vision in damaged.

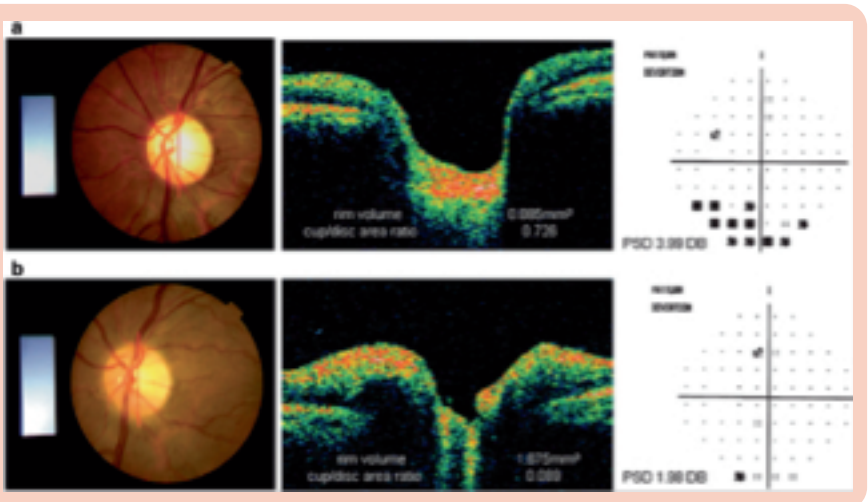
This glaucoma damage is irreversible and permanent. If the damage is severe then blindness can result. Treatment is directed at lowering the pressure down to normal thus preventing the vision being damaged.

TYPES OF GLAUCOMA

Primary or Chronic Open angle glaucoma (POAG) or (COAG)

Open angle glaucoma is the commonest type of glaucoma in the UK accounting for over 90% of all cases of glaucoma and about 50% of glaucoma blindness. In the UK, it is estimated that 0.3% of 40 years have COAG, increasing to about 3.3% in people who are 70years old [2] and higher in older age groups, and up to10% in over 80s. The incidence and severity of glaucoma is higher in people of black African descent or who have a family history of glaucoma.

Figure 1: Optic nerve damage of disc **(a, b)** with corresponding OCT and field changes in open angle glaucoma.



Presentation: Open angle glaucoma is painless and causes gradual deterioration of the field of vision. Typically causing extensive loss of the peripheral field of vision before the patient becomes aware of any symptoms. It tends to be bilateral but asymmetrical **(figure 1)** with one eye being much more affected than the other. Sometimes there is only a tiny island of vision left in the worse eye before the sufferer becomes aware of the field defect hence the term “Glaucoma silent thief of sight”.

Narrow angle and Acute angle closure glaucoma

Narrow angle glaucoma is more common in people of East Asian descent. It can present either as an acute episode Acute Angle Closure Glaucoma (AACG) or as Chronic Narrow Angle Glaucoma (CNAG)and occasionally a combination of both – acute on chronic. The typical presentation of AACG is:

- severe pain in and around the affected eye
- headache
- nausea
- vomiting
- blurred vision
- red eye
- ground glass appearance of the cornea (corneal oedema)
- mid-dilated pupil that has minimal or no reaction to light.

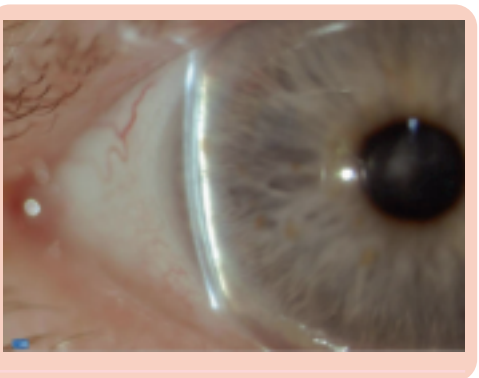


Figure 2: Slit lamp examination - von Herrick method showing shallow anterior chamber.

An attack of acute angle closure glaucoma may be induced after instilling drops that dilate the pupils in a person who already has narrow angles. Prior to presenting with angle closure, people at risk may give a history suggestive of sub acute attacks – such as having headaches or seeing haloes around light after being in dimly lit conditions such as night driving.

The presentation of Chronic Narrow angle glaucoma is similar to open angle glaucoma – in which it is asymtomatic and detected at a routine eye check by the optometrist.

Other less common forms of glaucoma

- Neovascular glaucoma – this occurs as a result of ischeamic insult to the eye such as proliferative diabetic retinopathy or central retinal vein occlusion when new vessels appear in the angle
- Secondary glaucomas
- Pigment dispersion glaucoma
- Trauma
- Anterior segment anomalies
- Pseudo exfoliation – more common in Scandinavians
- Juvenile glaucoma
- Congenital glaucoma

SCREENING FOR GLAUCOMA

A Health Technology Assessment (HTA) [2] published in 2007 reported on the clinical effectiveness and cost-effectiveness of screening for open angle glaucoma In the UK, the National Screening Committee (NSC) provides advice to the government on which population-screening programs should be introduced.

Population screening would only be considered for conditions that satisfy these criteria:

- *An important public health problem*
- *Has an acceptable test or combination of tests that are able to detect sufficient amount of people at risk to justify testing large numbers of population who are not at risk*

- *The programme is cost- effective and practically feasible*
- *The benefits of screening outweigh the risks*
- *Appropriate diagnostic and management facilities to care for people with detected disease must be available*
- *Early treatment must be effective and acceptable*

The HTA found that population screening is not cost- effective for open angle glaucoma, but targeted screening of high-risk groups may be. It reported that of an estimated half a million people affected by COAG, 67% are undetected. Several risk factors were identified, for people in the 40–75 year age group, prevalence estimates for these risk factors are:

Myopia - 2.7%

Diabetes - 3.3%

A positive family history of glaucoma in a first-degree relative - 6.7%

African ethnicity - the risk is four times higher than the general population

In this report the main determinant of cost-effectiveness was prevalence. Prevalence would have to be about 3–4% in 40 year olds with a screening interval of 10 years for screening to approach cost-effectiveness. Prevalence of glaucoma in this age group is under 0.5%. General population screening at any age, thus, appears not to be cost-effective. Selective screening of groups with higher prevalence (black ethnicity and family history) might be worthwhile, although this would only cover 6% of the population. Extension to include other at-risk cohorts (e.g. myopia and diabetes) would include 37% of the general population, but the prevalence is then too low for screening to be considered cost-effective.

The future of screening for glaucoma

There has been a significant advancement in the quality and precision in non-contact and minimally invasive technology for the screening of glaucoma since the last HTA. With these developments, screening for glaucoma may well become feasible at national level in a systematic way in the not distant future. [1]

It is my opinion that the feasibility for a national screening programme for glaucoma may materialise sooner than expected because of a combination of improvements in screening technology as well as better identification of the population at risk with the use of:

- Improved targeted campaigns via social networking as well as traditional methods of information dissemination
- Wider adoption and improved efficiency of more comprehensive electronic patient records
- Improvements in telemedicine

Opportunistic case finding

In the UK most opticians check the intra ocular pressure at routine eye check. Many patients with signs suggestive of early glaucoma are identified at this informal screening opportunity before much damage is done. Nature supports this as most people start to need reading glasses at around the age of 40 necessitating a visit to the optometrist.

Another important source of opportunistic referrals for glaucoma are diabetic retinopathy screening programme screeners. Referrals are made to the local glaucoma service for further investigations and treatment following discovery of unusual disc appearances such as large cup – disc ratio and / or disc haemorrhage **(figure 3)** observed when screening for diabetic retinopathy.

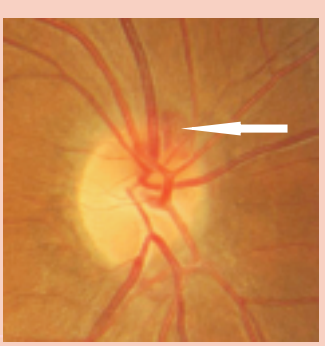


Figure 3: Optic disc flame shaped haemorrhage.

INVESTIGATIONS FOR GLAUCOMA

Because the loss of sight with primary open angle glaucoma is asymptomatic till the end stages of the disease, detection tends to be opportunistic or by screening. Once referred, further tests are carried out in the glaucoma clinic to confirm the diagnosis and monitor the progress of the disease.

EXAMINATION

- Tonometry – The gold standard for measuring intra-ocular pressure is the Goldman tonometer. Normal intraocular pressure is between 10 and 21mmHg. However a few people suffer glaucomatous damage within this normal range.
- Anterior segment assessement – the depth of the anterior chamber is assessed to determine if the angle is open, narrow **(figure 2)** or closed. Evidence of excess pigment dispersion including presence of pigment on the endothelium and iris transillumination is assessed. Presence of pseudo exfoliation on the pupil margin and lens capsule is observed.
- Gonioscopy **(figure 4)** - Observation of the angle of the anterior chamber for traumatic damage, congenital anomalies and any unusual or excessive deposition of pigment is made.

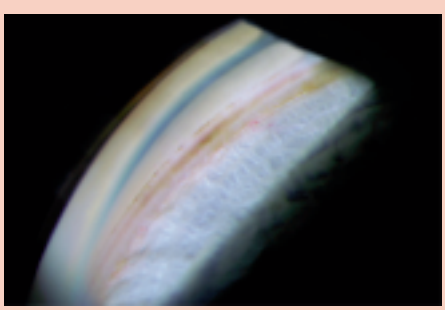


Figure 4: Gonioscopy showing open anterior chamber angle.

- Optic disc assessment – Any deviation or progressive change of the size, shape and cup to disc ratio of the optic disc is recorded. There is a wide range of 'normal' cup to disc ratio (CDR) with significant overlap of normal and pathological based on CDR only. A large disc could be healthy with a CDR of 0.8 while a small disc could exhibit glaucoma damage with a CDR of 0.4.

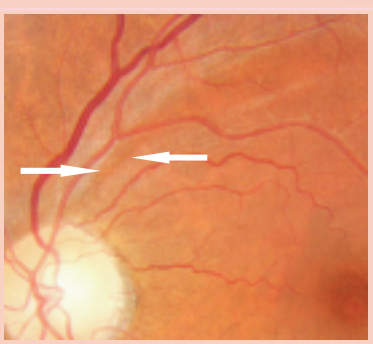


Figure 5: White arrows shows retinal nerve fibre layer defect

The ISNT rule is useful in evaluating whether thinning is physiological or pathological. A healthy disc tends to be thickest (I) inferiorly, then (S) superiorly, then (N) nasally, with the thinnest portion being (T) temporally. What matters in deciding if cupping is pathological is evidence of deviation from the ISNT rule; focal defects in the optic disc and the retinal nerve fibre layer **(figure 5)** and progressive change on sequential monitoring. Also presence of disc haemorrhages particularly flame shaped haemorrhage **(figure 3)** at the disc is significant for the development of glaucoma.

Visual Field testing

Standardised forms of visual field testing is used to assess and map the light sensitivity of each eye. The aim is to map the minimum brightness required for the detection of a light stimulus at each location (the threshold) and record how this progresses over time. Most field testing is done by automated static threshold testing. Many of the machines that perform automated testing have comparative database for the age of the patient and some computerised programming to suggest the likelihood of field changes being the result of glaucomatous damage.

The first signs of vision being damaged in progressive glaucoma is usually the development of blind spots above and/or below the line of vision. Untreated, these blind spots enlarge and join together and eventually only the central field remains. Ultimately this too disappears and the eye is completely and irretrievably blind.

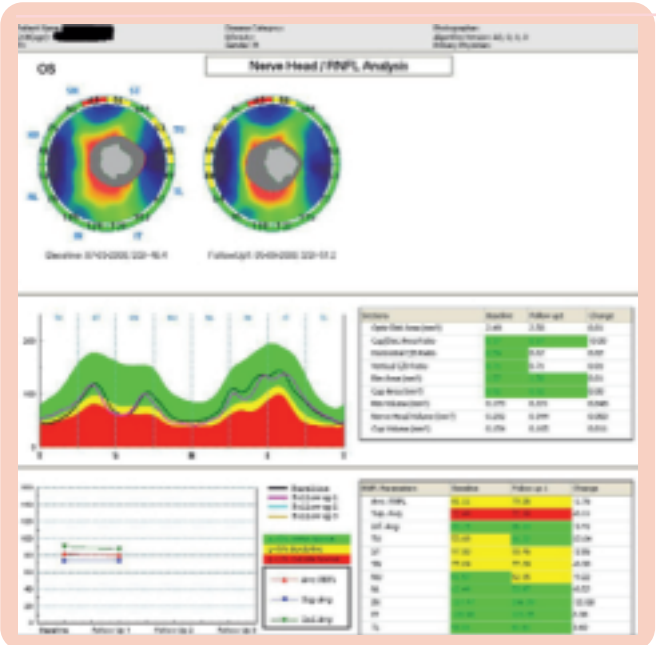


Figure 6: OCT showing small changes on sequential imaging.

OCT

(Optical Coherence Tomography) of the Optic nerve head and the ganglion cell layer: This measures the thickness of the layer of nerve fibres, which carry the vision to the optic nerve. **(figure 6)**

The OCT has become an important tool in refining earlier diagnosis and treatment of glaucoma than ever before. In some people OCT changes are detected up to 5 years earlier than recordable visual field changes on formal testing.

Central Corneal Thickness measurement

This is done either optically or by ultrasound. People with thinner corneas have been found to have glaucomatous damage at lower pressures than those with normal or thicker corneas – so the assumption is that intraocular pressure is underestimated when measured by current techniques in these patients. Measuring the corneal thickness is valuable in adjusting intraocular pressure measurements achieved by Goldman tonometry.

TREATMENT

Following history, examination and investigations, a decision to treat is made either because

a) A patient has clear evidence of nerve damage and loss of vision from glaucoma, or

b) The risk profile suggests treatment is likely to be beneficial even when there is no evidence yet of damage. Risk profiling takes into account a combination of factors including age, family history, ethnicity, co-morbidities such as diabetes, raised intra-ocular pressure and low central corneal thickness and disc appearance. Once a patient is diagnosed as having glaucoma, it is important that they appreciate the need for lifetime follow-up.

Treatment modalities for glaucoma

A: Eye drops: often the first choice for treating glaucoma.

There is a wide range OF classes of drops, and the more commonly used ones nowadays are:

- Prostaglandin analogues – Bimataprost (Lumigan), Tafluprost (Saflutan), Travaprost (Travatan) Latanoprost (Xalatan)
- Beta blockers - Timolol (timoptol) Betaxolol (Betoptic) Levobunolol (Betagan)
- Combination of prostaglandin and timolol Travaprost + timolol (Duotrav), Bimataprost+ timolol (Ganforte), Latanoprost + Timolol (Xalacom)
- Carbonic anhydrase inhibitors (CAI) Dorzolamide (Trusopt), Brinzolamide (Azopt)
- Combination of CAI and timolol : (Cospopt, Azarga)
- Alpha agonist: Apraclonidine (Iopidine) Brimonidine tartarate (Alphagan)
- Others not so commonly used in the UK but still in use in other parts of the world:

Parasympathomimetic: Pilocarpine – Used mainly for narrow angle glaucoma while waiting for laser treatment or surgery.

B: Tablets

- Acetazolamide (Diamox)

C: Laser

There are 5 main laser modalities for treatment of glaucoma.

- Laser Iridotomy – for acute angle closure glaucoma and as a prophylaxis in people with narrow anterior chamber angle deemed to be at significant risk of angle closure.
- Selective laser trabeculoplasty – for open angle glaucoma.
- Argon laser trabeculoplasty.
- Micropulse laser trabeculoplasty.
- Cyclodiode laser treatment – this is usually reserved for patients who have not responded to other medical and surgical treatments; particularly those with neovascular glaucoma.

D: Surgery

- Trabeculectomy - the widely performed surgery for glaucoma. The operation creates a bypass for the escape of aqueous humor when the normal drainage channels are blocked.

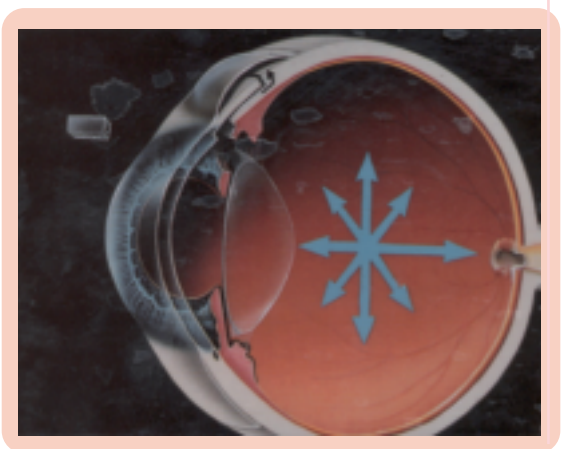
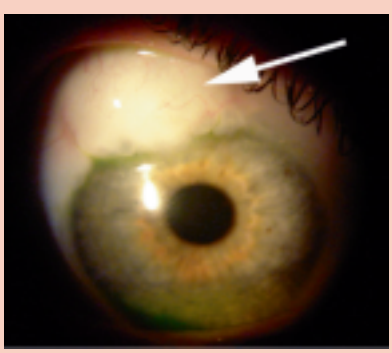


Figure 8: Graphic illustration of effect of high intraocular pressure on the optic disc and trabeculectomy surgery.



A fistula **(figure 8)** is created by removing piece of tissue in the drainage angle of the eye creating an opening. The opening is partially covered with a flap of tissue from the sclera, the white part of the eye (sclera), and the conjunctiva, the clear thin covering over the sclera. This new opening allows the aqueous humor to drain out of the eye, by-passing the clogged drainage channels of the trabecular meshwork. As the fluid flows through the new drainage opening, the tissue over the opening rises to form a little blister or bubble, called a bleb **(figures 8,9)**.

Figure 9: Post op photo – arrow end showing a bleb.

Other forms of glaucoma surgery:

- Glaucoma tube surgery
- Viscocanalostomy
- Canaloplasty.

SUMMARY

Most patients with glaucoma retain good vision indefinitely. Modern treatment is easy and very effective in patients in whom the disease is detected early. Only a small number of patients lose significant vision.

References

1. *http://www.screening.nhs.uk/glaucoma* - accessed 02/02/2014

2. The clinical effectiveness and cost-effectiveness of screening for open angle glaucoma: a systematic review and economic evaluation JM Burr et al. Health Technology Assessment 2007; Vol. 11: No. 41

Diabetes UK in 2014 – a major focus on children and footcare

There is room for improvement in many aspects of diabetes care and campaigning for better standards for people with diabetes is a key part of Diabetes UK's mission. This year, two campaigns in particular – the Children and Young Person's campaign, and the Putting Feet First campaign – have ambitious plans to improve the healthcare picture for people with diabetes. **Dr Susan Aldridge**, Editor of *Diabetes Update*, the charity's magazine for healthcare professionals, introduces the campaigns and explains why they are relevant to the retinal screening community.

As discussed in the last issue of *Diabetic Eye Journal*, Diabetes UK places great emphasis upon its 15 Healthcare Essentials campaign (see box), which aims to ensure that people with diabetes get the care and support they need and deserve to live a long and healthy life. As healthcare professionals, you can use the Essentials to work with your diabetes patients to make sure they are receiving their regular checks including, of course, their annual retinal screening.

But there are also specific areas of diabetes care where more targeted campaigning is also needed. Diabetes UK's Children and Young Person's Campaign aims to remedy the fact that 85 per cent of this group does not achieve the recommended blood glucose level and address other indicators of sub-optimal diabetes management. Why does this matter to healthcare professionals involved in retinal screening? Because better diabetes control at a young age should mean that you have to deal with fewer eye complications in later life.

Meanwhile, it is a sad fact that nearly a third of people with Type 1 diabetes did not receive their annual foot check, according to recent figures, laying themselves open to serious complications, including amputation. That is why Diabetes UK is continuing its Putting Feet First campaign through 2014. When your patient has their retinal screen, do you ever ask them if they have had their foot check too? Diabetes affects the whole body and a foot amputation is as devastating as loss of vision.

The Children and Young Person's Campaign

Not only do the majority of children and young people over the age of 12 have higher than recommended blood glucose levels, recent evidence also suggests that 25 per cent of all children with Type 1 diabetes are not actually diagnosed until they present with diabetic ketoacidosis (DKA). This is clearly not just traumatic for the child and their family, it is also very costly to the NHS. When it comes to having their essential checks, less than 6 per cent of children and young people are having all the recommended care processes recorded. These deficiencies eventually take their toll on these young people, for mortality among those with Type 1 diabetes is nine times higher for females in the 15-34 age group than for those without diabetes and, for males, it is four times higher. A contributing factor to these shocking statistics may be poor transition to adult diabetes services which may lead to some young people disengaging from their care.

DIABETES UK

CARE. CONNECT. CAMPAIGN.

Diabetes UK's Children and Young People campaign has four phases – as follows:

Phase 1 aims to ensure prompt and accurate diagnosis of Type 1 diabetes in children and young people and so reduce the number who are not diagnosed until they are in DKA.

Phase 2 will raise the profile of diabetes in children and young people as a serious condition and emphasise that all families affected by it require ongoing, high-quality care and support to manage it in all aspects of their life.

Phase 3 will focus on improving the support for children with diabetes in schools and other educational settings.

Phase 4 aims to improve transition between paediatric and adult diabetes services.

The four-year campaign was launched on World Diabetes Day, November 14, 2012. It began by pushing awareness of the 4 Ts of diabetes – namely Toilet, Thirsty, Tired and Thinner – all of which should be 'red flag' symptoms to parents and carers. Everyone who knows a child, of any age, needs to be aware of the 4 Ts of Type 1 diabetes and be prepared to refer that child for medical advice immediately, should they spot them. If a child or young person shows any of the 4 Ts, they should have a capillary blood test straight away and if the result indicates Type 1 diabetes be referred to the local paediatric diabetes team immediately.

Phase 1, which is ongoing, is already achieving results, for awareness of the 4 Ts went up to 14 per cent compared with just 9 per cent in 2012, which is a significant improvement.

Phase 2 of the Children and Young People's campaign began last year with a Parliamentary lobby aimed at getting parents, children and young people to understand what good diabetes care looks like. Diabetes UK wants them to make sure all children with Type 1 are getting top marks ('10/10') when it comes to getting all the diabetes checks, help and support they need and, crucially, to know what to do if this is not happening.

In 2014, the charity begins on *Phase 3* of the Children and Young People's Campaign, with a focus upon diabetes care in schools. This got off to an excellent start with Secretary of State for Education, Michael Gove, announcing (in October 2013) that it will be mandatory for schools in England to provide appropriate care for children with diabetes. This is a development that Diabetes UK has pushed hard for, but there is much more to do. Over the course of this year, the charity will be aiming to make children and parents aware of their rights and it will also be working with schools to help them put the right care in place.

The footcare campaign

Diabetes UK launched Putting Feet First in early 2012, with the aim of reducing the number of diabetes-related amputations. Foot disease and amputations are a serious consequence of poorly controlled diabetes and the fact is that 80 per cent of those amputations are potentially preventable, if only people have access to good-quality and structured care for their feet. In January 2013, Health Secretary Jeremy Hunt aligned himself with our aims by saying he wanted to see amputations down by 50 per cent by 2017.

The focus of the footcare campaign is to raise awareness of the impact of diabetes on the feet among people with diabetes, healthcare professionals and the public. To this end, Diabetes UK has been supplying campaign materials covering standards and good practice guidance, together with advice on what to do if the recommended care is not being received.

Putting Feet First began from a basis of nearly one third of people with Type 1 not getting their annual foot check (in 2009-2010) and less than half of those with any type of diabetes having the risk to their feet clearly explained to them.

Diabetes UK wants to make sure that foot protection services are readily accessible to people with diabetes. A multidisciplinary team, made up of healthcare professionals with specialist expertise in assessment and management of diabetic foot disease, should be at the heart of such services. At present, only two thirds of hospitals in England have such a team; an increase since the campaign launched, but more still needs to be done. Through the foot campaign, the charity is engaging with healthcare professionals, managers in the healthcare service and local decision makers (CCGs) to promote the high-quality integrated foot services that people with diabetes need. As with the Children and Young People's Campaign, we feel we are making significant progress – for we have successfully pushed target CCGs with high amputation rates into making concrete commitments to get these rates down.

Diabetes UK's 15 Healthcare Essentials (see DEJ issue 1) refers to the care that children and young people should receive (Essential 11 'If you are a child or young person, care from diabetes paediatric healthcare professionals'). Furthermore, children should also receive more frequent check for HbA1c, weight, height and general health, and formal screening for complications from age 12. The Essentials also highlight the importance of footcare (Essential 5 calls for an annual foot check for all people with diabetes).

For more on Diabetes UK's 15 Healthcare Essentials, go to *www.diabetes.org.uk/essentials*

How you can help

For someone with diabetes, every contact with a healthcare professional counts, including their appointment with the retinal screener. So, when you next see a patient for their screen, might there be an opportunity to chat with them – however briefly – about diabetes-related matters, such as take up (and availability) of their other essential checks?

Diabetes UK's campaigns need supporters to demand better services for people with diabetes – they are nothing without them. Could you be one of them? Maybe you're fired up about foot care services for people with diabetes, or perhaps you're keen to get involved in making sure children with diabetes receive better care. It is, after all, vital to receive diagnosis and care right from the very beginning, because it minimises problems – including eye problems – later on. If so, why don't you sign up to Diabetes Voices, Diabetes UK's network for people who campaign and influence for better services and care. We'll send you updates, resources and details of actions that you can take that will really make a difference to people living with diabetes. In short, Diabetes UK needs your help, by being a campaigner for your patients – not just in eye care, but in all other aspects of diabetes.

DIABETES UK
CARE. CONNECT. CAMPAIGN.

Update from National Diabetic Eye Screening Programme

NHS Diabetic Eye Screening Programme

Common pathway update

The implementation of the NHS Diabetic Eye Screening Programme (NDESP) new common pathway in England is nearly complete. This major project will benefit patients by improving consistency in the early detection and effective treatment of sight-threatening retinopathy nationwide. The new pathway represents a substantial change in operational and reporting requirements for local programmes and significant software changes.

All but a few of the country's 84 programmes will have installed pathway compliant software by April 2014. Once national pathway implementation is complete, screening throughout England will be delivered consistently in accordance with the 2014/15 national service specification for diabetic eye screening, which describes how services must be commissioned and delivered.

The new pathway and service specification will ensure all local programmes deliver screening in the same way. Key elements include:

Universal provision of referral outcome grading

Universal provision of digital surveillance and slit lamp biomicroscopy services

Features based grading of images and revised grading definitions

Consistency over what is commissioned as part of screening and what is commissioned as part of hospital eye services.

Implementation of the new pathway will enable NDESP to report reliable, comparable data that will help to identify outliers and improve quality.

NDESP continues to work closely with software suppliers and providers to ensure the remaining few local programmes will be using software that is robust, fit for purpose and meets common pathway functionality as soon as possible after April 2014.

Software contracts are held locally between suppliers and providers. Local programmes should therefore contact their suppliers directly if they have any queries relating to their software implementation. Programmes can email *dr.screening@nhs.net* if they require any advice from the national NDESP team.

National Diabetic Eye Screening Conference

Diabetic eye screening programme managers, clinical leads, screeners, graders, GPs, diabetologists, paediatricians, ophthalmologists, public health professionals and commissioners are invited to register for the 2014 National Diabetic Eye Screening Conference.

The conference is being organised by the Royal Society of Medicine (RSM) in association with NDESP and will be held at the RSM, Wimpole Street, London, on Wednesday 30 April. This year's theme is 'Integration – where do I fit in?'

Speakers will include members of the NDESP national team and UK National Screening Committee as well as representatives from ophthalmology, diabetology, primary care, service users and the national programmes of Scotland, Wales, Northern Ireland and the Republic of Ireland. The agenda will cover the new common pathway for diabetic eye screening, the role of IT, integrating quality assurance into screening and the role of paediatric diabetology in the screening of young people with diabetes.

To register your interest, please visit the RSM website at *www.rsm.ac.uk*

Transfer of patient data between GP practices and local diabetic eye screening programmes

NDESP aims to greatly enhance the process of cohort identification and the transfer of patient data between GP practice systems and local programmes by rolling out the national GP2DRS IT solution.

The General Practice Extraction Service (GPES) will be used to extract cohort information nationally from GP systems into GP2DRS because GPES offers the best option for achieving a comprehensive national data extraction.

Developing services to ensure a reliable and comprehensive data transfer from GP practices to the central GP2DRS database has proved more complex and time consuming than first anticipated. As a result, the expected 'go live' date for GP2DRS has been back put back to April 2014.

Screening for pregnant women

The UK National Screening Committee is currently reviewing and revising the printed information on antenatal and newborn screening provided to women in pregnancy.

This will include information on the importance of the additional retinal screening tests provided during pregnancy for women with diabetes due to the increased risks to both mother and baby associated with the condition.

Pregnant women who have type 1 or type 2 diabetes are offered additional screening tests for diabetic retinopathy at, or soon after, their first antenatal clinic visit and also after 28 weeks of pregnancy. If early stages of retinopathy are found at the first screening, they are offered another test between 16 and 20 weeks of pregnancy.

Women who develop hyperglycaemia (high blood sugar) – also known as gestational diabetes – during pregnancy are not offered a diabetic eye screening test.

Managing incidents in diabetic eye screening programmes

The UK National Screening Committee's updated interim guidance on managing incidents in NHS screening programmes, including diabetic eye screening, is now available.

This guidance clarifies the roles and responsibilities for reporting, investigating and managing screening incidents in the context of the changes to commissioning and public health from April 2013. The document can be downloaded from the UK Screening Portal at *www.screening.nhs.uk/incidents*.

National Diabetic Eye Screening Programme for England is part of National Screening Commitee. To find out more visit: *http://www.screening.nhs.uk/england*

Furosemide as a Treatment of Diabetic Macular Oedema in Pregnancy

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We report two cases of diabetic macular oedema arising in pregnancy, one in the context of proliferative retinopathy before pregnancy and one with maculopathy treated pre-pregnancy. Both responded favourably to oral Furosemide.

Introduction

Pregnancy increases the risk of deterioration of diabetic retinopathy. The level of risk is determined by the degree of retinopathy pre-pregnancy [1], by the duration of diabetes [2] and by the level of blood glucose control prior to pregnancy as indicated by periconception glycated haemoglobin (HbA1c). In Type 1 Diabetes the risk of retinopathy worsening, relative to that of a non-pregnant woman with diabetes, is increased between 1.63 and 2.48 fold depending on the degree of blood glucose control [3]. Sight-threatening deterioration is associated with the presence of higher blood pressure, impaired visual acuity and macular oedema early in pregnancy [4].

Macular oedema may develop during pregnancy. It is commonly associated with proteinuria and/or hypertension and can be exacerbated by panretinal photocoagulation (PRP) for proliferative retinopathy [5]. The benefit of grid laser treatment for macular oedema during pregnancy is disputed [6] especially as macular oedema has a high rate of spontaneous resolution following delivery [7]. A medical approach to treatment is therefore attractive.

Case 1

A 35 year old with Type 1 Diabetes from age 16 developed macular oedema in both eyes at 17 weeks' gestation in her first pregnancy. Background retinopathy had first been noted 10 years pre-pregnancy. 4 years before conceiving, digital retinal screening grade progressed from macular microaneurysms and background change to referable maculopathy prompting a referral to the Hospital Eye Service. Left focal laser was administered. Subsequent development of proliferative retinopathy required extensive panretinal photocoagulation (PRP) to both eyes. On the right she had a good response with fibrosed vessels and 6/6 vision but on the left there was a persistent disc vessel with 6/9 vision despite extensive PRP. Further PRP was withheld because the new vessels were stabilised, and her visual fields were borderline on visual field testing for DVLA fields. The patient had not been planning pregnancy when last reviewed in the ophthalmology clinic.

Review in the first trimester of pregnancy revealed stable new vessels in the inferotemporal region of the right retina and fine stable disc new vessels in the left. The maculae were dry. HbA1c dropped from 8.5% to 6.7% in 2 months. Top up PRP was administered to the right eye. During the 2nd trimester she developed bilateral cystoid macular oedema. Visual acuity (VA) dropped from 6/5 right eye and 6/9 left eye to 6/7.5, 6/12 respectively. Optical coherence tomography (OCT) scanning confirmed bilateral cystoid macular oedema (**figure 1 a,b**). Treatment with Furosemide 40mg once daily was instituted at 21 weeks' gestation (**figure 1 c,d**). Following this, VA improved to 6/6 on the right and 6/9 on the left and OCT scan showed reduction in oedema on the left although no change on the right (**figure 1 e,f**). She maintained 6/6 vision on the right throughout pregnancy and no laser treatment was given.

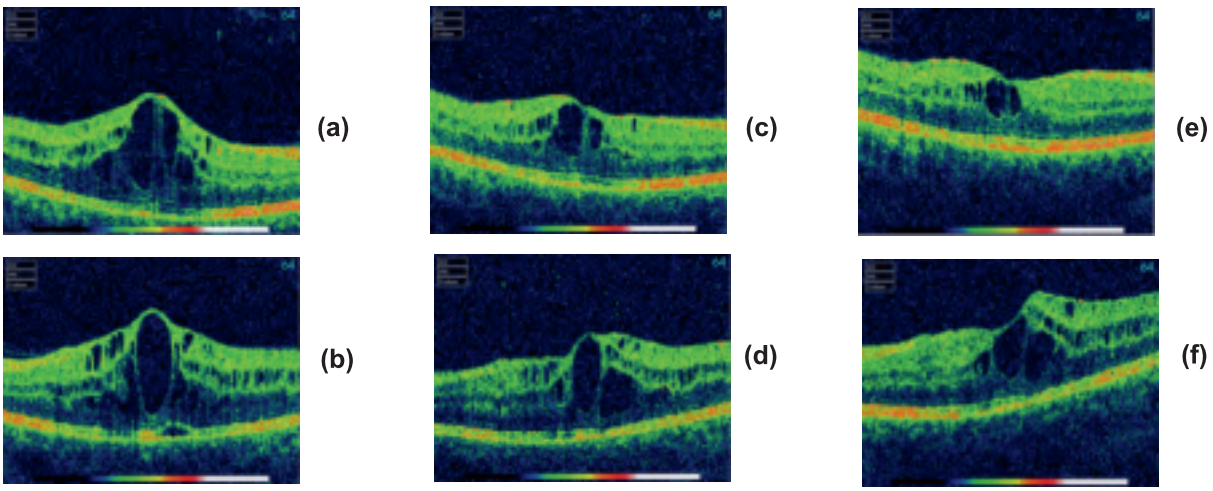


Figure 1: OCT scans showing macular oedema: **(a)** right eye 17 weeks pregnant. **(b)** left eye 17 weeks pregnant. **(c)** right eye 21 weeks pregnant. **(d)** left eye 21 weeks pregnant. Furosemide instituted. **(e)** right eye 31 weeks pregnant **(f)** left eye 31 weeks pregnant.

She then sustained a sudden loss of vision in the left eye at 32 weeks due to a vitreous haemorrhage **(figure 2)** resulting in counting fingers visual acuity. After some initial clearing a further vitreous haemorrhage was thought to have occurred and by 34 weeks VA was 6/5 right and remained counting fingers left.

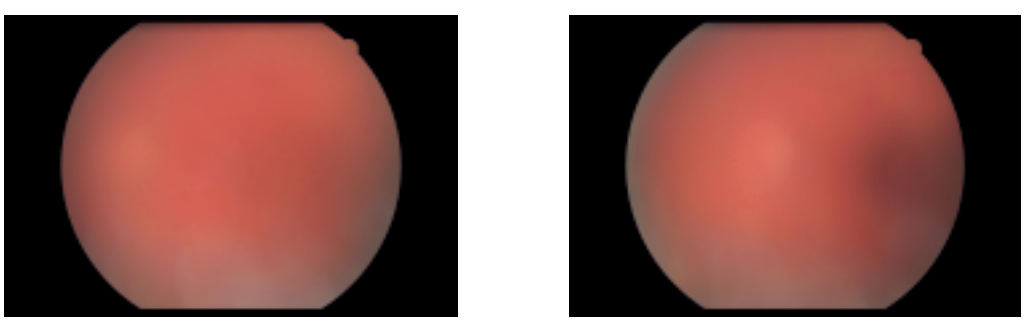


Figure 2: Vitreous haemorrhage in Left Eye.

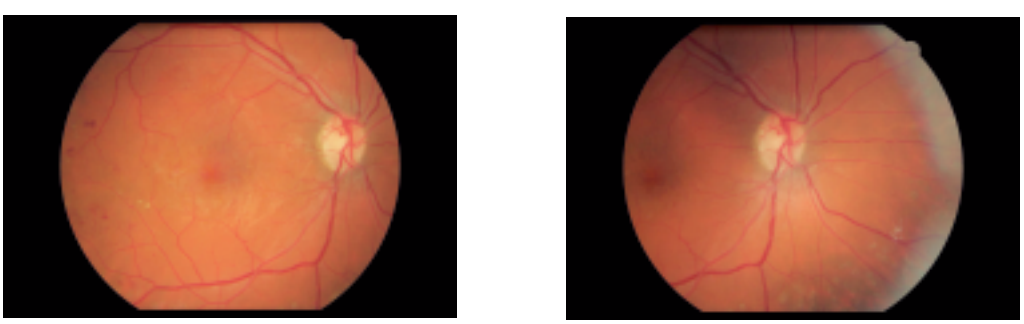
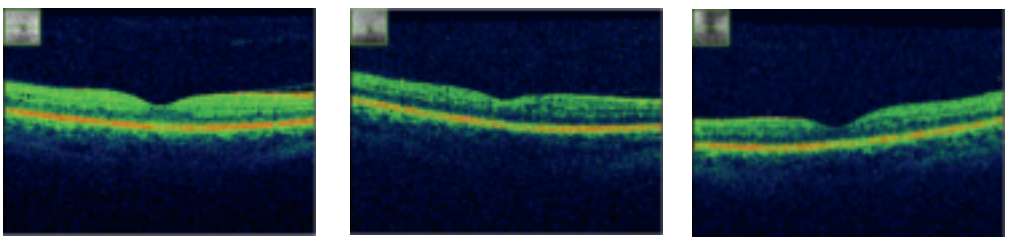


Figure 3: Retinal images of Right Eye at 33 weeks of gestation showing active New Disc Vessels.

The medical background was suboptimal metabolic control periconception with HbA1c of 8.8%. Blood Pressure (BP) was 118/81 and urinary albumin excretion was normal (albumin:creatinine ratio (ACR) 0.2, reference < 3.5). Her diabetes was well-controlled during the 2nd and 3rd trimesters. She developed no hypertension, peripheral oedema or proteinuria. In view of her retinopathy, elective Caesarean Section was undertaken under spinal anaesthesia at 37 weeks and she was delivered of a live female infant weighing 3280g (birth weight appropriate for gestational age).

48 hours after delivery Furosemide was discontinued. 3 months later VA was 6/6 on the right with almost complete resolution of macular oedema (**figure 4 a**) but the dense vitreous haemorrhage persisted in the left with VA Counting Fingers, precluding retinal examination and OCT.

Ten months after delivery a left vitrectomy was performed. Eighteen months post pregnancy she has a 6/7.5 right and 6/9.5 left visual outcome. The right disc vessel has regressed without further laser, her maculae are dry with just a tiny cyst at the right macula and there is no active retinopathy on the left (**figure 4 b,c**).



(a) (b) (c)

Figure 4: OCT scans showing regression of macular oedema: **(a)** right eye 3 months after delivery. **(b)** right eye 18 months after delivery. **(c)** left eye 18 months after delivery.

Case 2

A 28 year old pregnant woman with type 1 diabetes of 18 years' duration had previously attended another hospital for diabetes supervision and focal laser treatment of right-sided diabetic maculopathy and then presented for antenatal care at 20 weeks' gestation to our unit. Her blood glucose had been well-controlled on a basal-bolus insulin regimen using the insulin analogues insulin aspart and insulin detemir, with HbA1c of 6.3%. BP was 105/65 and she had normal urinary albumin excretion although she had required an ACE-inhibitor pre-pregnancy.

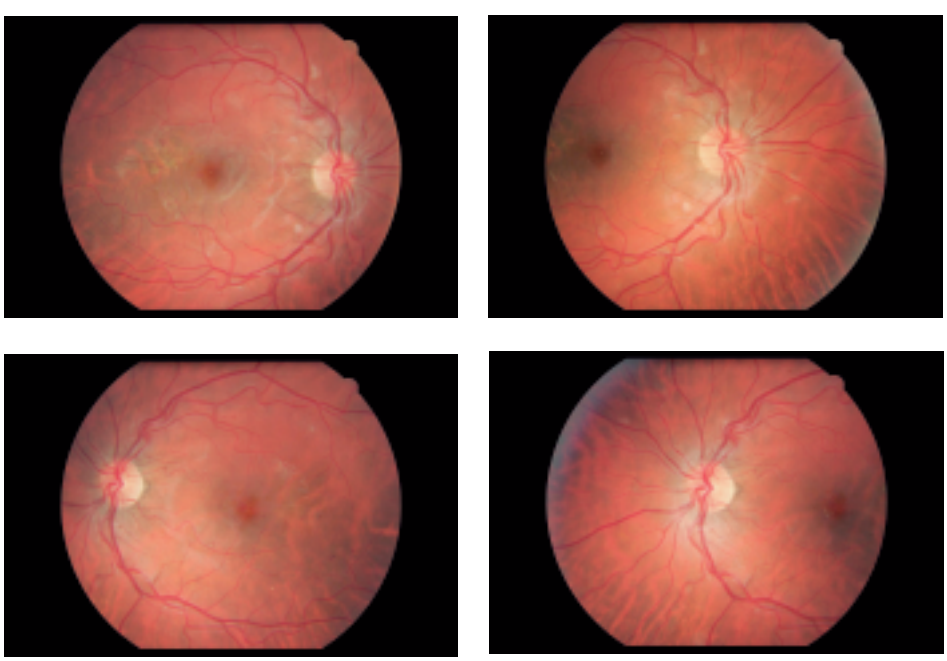


Figure 5: Background Diabetic Retinopathy and Exudates in Both Eyes.

At 20 weeks gestation, the ocular findings were a visual acuity of 6/6 bilaterally and digital imaging showed moderate background diabetic retinopathy with macular microaneurysms and exudate in both eyes (graded right eye R1M1P, left eye R1M1) **(figure 5)**.

No macular oedema was evident on slit-lamp examination but the OCT scan revealed early fluid accumulation but with normal foveal thickness (**figure 6 a,b**). At 28 weeks of pregnancy she was found to have bilateral cystoid macular oedema and peripheral oedema (**figure 6 c,d**). BP was 134/76 and she had a normal ACR of 0.5. Initially VA was unaffected, 6/5 right, 6/6 left but at 30 weeks she reported a sudden deterioration in vision correlating with a drop in VA to 6/9 right, 6/15 left. Diastolic BP had risen to 132/85, but blood glucose control remained excellent with HbA1c of 6.1%. OCT scan showed diffuse macular oedema but with little deterioration (**figure 6 e,f**). Treatment with oral Furosemide 40mg daily was instituted.

She reported an improvement in her visual acuity within the first 24 hours of starting treatment and maintained a VA of 6/6 right and 6/7.5 left at 34 weeks. OCT scan however, showed slight progression of macular oedema in both eyes (**figure 6 g,h**) and Furosemide dose was increased to 40mg twice daily. She developed no proliferative retinopathy.

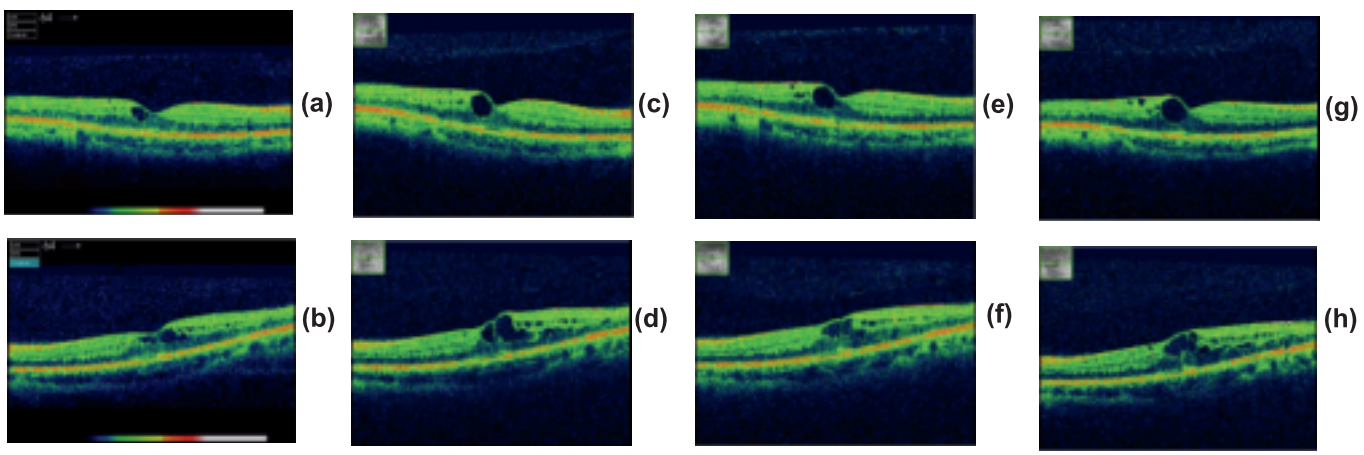


Figure 6: OCT scans showing macular oedema: **(a)** right eye 20 weeks pregnant. **(b)** left eye 20 weeks pregnant. **(c)** right eye 28 weeks pregnant. **(d)** left eye 28 weeks pregnant. **(e)** right eye 30 weeks pregnant. **(f)** left eye 30 weeks pregnant. Furosemide instituted once daily. **(g)** right eye 34 weeks pregnant. **(h)** left eye 34 weeks pregnant. Furosemide increased to twice daily.

At 38 weeks she went into labour spontaneously and was delivered per vaginam of a live female infant weighing 2800g. Furosemide was discontinued 72 hours after delivery. 6 weeks post-partum VA was 6/6 right, 6/6 left and OCT scan confirmed almost complete resolution of the macular oedema on the right but 2 small cysts on the left (**figure 7 a,b**).

Eighteen months after delivery she has a 6/5 right, 6/5 left visual outcome. She has had no further laser but has started taking Lisinopril for hypertension. Her maculae are dry with just a tiny fluid cyst at the right macula and small fluid cysts on the left (**figure 7 c,d**).

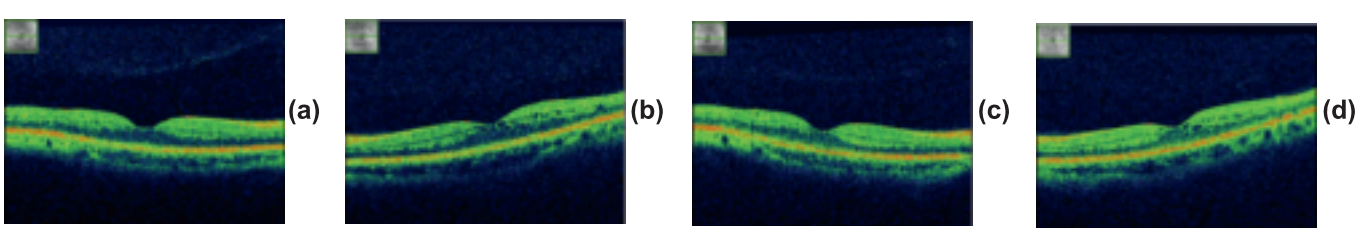


Figure 7: OCT scans showing regression of macular oedema: **(a)** right eye 6 weeks after delivery. **(b)** left eye 6 weeks after delivery. **(c)** right eye 18 months after delivery. **(d)** left eye 18 months after delivery.

Discussion

In normal pregnancy retinal blood flow is “protected” from the rise in systemic blood flow which results from increased cardiac output and plasma volume. This protection is lost, however, in some women with diabetes where the first trimester sees an increase in retinal blood flow. Whether this represents a failure in autoregulation or the overriding effect of local hypoxia is uncertain but these are the women whose retinopathy progresses in pregnancy [2].

Vestgaard studied 102 pregnancies in women with type 1 diabetes and found that 4 of the 16 women who had macular oedema at baseline developed sight-threatening progression in pregnancy. In 1984 Sinclair reported a series of 7 women who developed severe macular oedema during pregnancy in association with preproliferative or proliferative retinopathy [5] and reported that the oedema worsened in all cases during pregnancy and regressed postpartum in some. In an even earlier report [8] Cassar described marked clearing of macular oedema in pregnancy with diuretics and a salt-free diet but gave no details of the diuretics used. The patient’s vision improved from 6/18 right, 6/12 left to 6/9, 6/6 respectively after administration of diuretics during pregnancy and further to 6/5 bilaterally after delivery. We have found no subsequent reports of diuretic use in pregnancy for this condition.

Outside pregnancy, Ciardella [9] reported diffuse macular oedema responding to furosemide given for treatment of nephrotic syndrome in diabetic retinopathy and nephropathy with subjective improvement in vision, improved visual acuity and partial resolution on OCT scanning.

The decision we faced as to whether to proceed to use furosemide in pregnancy lay in the balance between potential preservation of maternal vision and potential harm to the foetus. The Medicines and Healthcare Regulatory Agency (MHRA) advises [10] that, because Furosemide crosses the placental barrier, it must not be given during pregnancy “unless there are compelling medical reasons”. The main concern is that a fall in maternal plasma volume may retard foetal growth and the MHRA therefore advises that treatment during pregnancy requires monitoring of foetal growth. We were reassured by a recent review of the evidence finding no outcome data to support these concerns [11] and by the routine monitoring of foetal growth in diabetic pregnancy [12] which, in both these cases, indicated normal growth velocity. Furthermore, Furosemide is used in cardiology in antenatal care for treatment of maternal fluid overload and ventricular failure [13].

A further concern was that macular oedema, like peripheral oedema, could be a common and essentially benign event in pregnancy. There is recent OCT scanning data that shows this not to be the case [14]. The lack of evidence for management of diabetic retinopathy in pregnancy and of macular oedema in particular is seen in a published Scandinavian Case Discussion [6] in which 3 experts disagreed on prognosis, laser treatment and the need for early delivery. The advent of digital retinal imaging and OCT scanning will enable more quantitative follow-up of pregnant women and better data to guide management.

Our experience of these 2 cases suggests that medical intervention with oral furosemide is a promising avenue for management of diabetic macular oedema to maintain vision during pregnancy. Further study into its use, both with and without laser, is warranted.

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