

'I cried for my lost sight.' Vision and diabetes

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Leonie: 'I became blind over the course of 12 months... It was mostly my fault. I was diagnosed with type 1 diabetes when I was a little girl... during my teens I discovered I could skip an injection without anything terrible happening... I stopped going to the doctor for annual check-ups. Throughout my student days I had a riot. I smoked, danced, partied, and kept on ignoring the fact I was diabetic.'

'One morning... as I looked in the mirror... I could see a ribbon of blood... As I looked left then right, the ribbon moved sluggishly as though floating in dense liquid... The optician took one look at the backs of my eyes and referred me to the nearest eye hospital...

'No-one ever came straight out and told me the consequences of having advanced diabetic retinopathy, it was always spoken of in terms of a progressive deterioration. I remember the day I admitted it to myself though. My sight had been steadily worsening... I was walking down the stairs at home when it hit me like the proverbial sledgehammer – I would be blind. With absolute certainty I knew I would lose my sight and that I only had myself to blame. I sat on the stairs and fell apart. I cried like a child. I cried for my lost sight, my broken dreams, my stupidity, for the books I would never read, for the faces I would forget, and for all the things I would never accomplish.'¹

Hyperglycaemia

'Most of the T2 is okay to handle – I'm eating healthily, exercising and have lost 10lbs since being diagnosed two weeks ago... But my eyesight has gone. My laser corrected perfect vision is blurred and I have to wear reading glasses... I am gutted. Will it ever come back, or have I got blurred close vision for ever? I want my old eyes back.'

'My eyesight went so screwy and blurry... I was having to wear my computer glasses to drive, for goodness sakes!! Close up vision was a nightmare... I was so worried I would go blind... thankfully, my blood sugar levels started to come down ... and my eye sight returned to normal ... for me.'²

As health care professionals we know that hyperglycaemia may cause blurred vision and should warn patients not to buy expensive new glasses until the glucose is controlled and stable. But how many of us consider the effect this has on the patient?

Hypoglycaemia

Hypoglycaemia, especially if prolonged, may produce visual symptoms. These include: unusual colours, e.g. pink sky; double vision; and tunnel vision. Detailed focusing may be difficult, e.g. when reading.

Colour vision

It has been known for over 40 years that people with diabetes may experience acquired colour vision impairment (ACVI).³

About 50% of patients in one study had abnormal hue discrimination. Factors linked with this were age, severity of macular oedema, and the presence of new vessels.⁴ Laser treatment may also alter colour vision.

Among people with diabetes in India without retinopathy gender-adjusted ACVI was 39.5% (CI 33.5–45.5). Women were at higher risk of ACVI (OR 1.79 [1.00–3.18]) than men. Other risk factors were raised intraocular pressure (OR 1.12 [1.00–1.24]), and resting heart rate (OR 1.04 [1.01–1.07]).⁵

Previously, self-monitoring of blood glucose (SMBG) required matching coloured strips against standard colours. Authors finding ACVI in 56/103 insulin-dependent patients advised excluding this before prescribing visually-read SMBG.⁶ Did anyone listen? People with diabetes may also misread coloured urine dipsticks.⁷

Among Japanese men aged 20–60 years without diabetic retinopathy, risk of ACVI was 0.77 (0.25–2.34) for those with impaired fasting glucose and 5.89 (1.55–22.40) for those with type 2 diabetes.⁸

Colour vision testing has been considered as a screening test to identify patients with, or at risk of, diabetic retinopathy – substantive evidence is lacking.⁹

Do people who delay seeking help for diabetic foot disease have problems recognising skin colour change? Perhaps. Primate colour vision may have evolved to recognise skin colour changes, e.g. denoting emotion.¹⁰

Contrast sensitivity

Contrast sensitivity is the contrast between objects and their backgrounds. Impairment may make night-time activities, e.g. driving, particularly difficult.

People with diabetes may have unrecognised contrast sensitivity impairment. Contrast sensitivity was assessed in middle-aged people with or without diabetes who had no eye disease. Those with diabetes had reduced contrast sensitivity.¹¹ Worryingly, impaired contrast sensitivity occurs in young people. In a group of 8–18 year-olds with or without type 1 diabetes, those with diabetes had reduced contrast sensitivity. Glycated haemoglobin was inversely correlated with contrast sensitivity thresholds.¹²

Older people with diabetes are more likely to fall than those without diabetes. 'Visual acuity, contrast sensitivity and depth perception were associated with falls in bivariate models. In a model combining these vision variables, contrast sensitivity remained statistically significant.'¹³

Visual field defects

Reduced visual field sensitivity was found in 26.3% of people with diabetes with no or mild retinopathy, rising to 72.3% among 'non insulin-dependent' patients with mild background retinopathy.¹⁴

Laser photocoagulation may produce peripheral defects. Stroke may cause homonymous hemianopia.

- Blurred vision
- Fluctuating vision
- Impaired colour vision
- Decreased contrast sensitivity
- Impaired night vision
- Impaired central vision
- Reduced visual field
- Reduced depth perception
- Blind spots or gaps in vision
- Curtains, veils, clouds, red streaks, or black dots in the vision
- Double vision

Box 1. Visual symptoms among people with diabetes

Laser photocoagulation

People with diabetes referred for laser photocoagulation treatment were asked about visual symptoms. Pre-treatment, 74.9% of those with maculopathy and 82.8% with proliferative retinopathy had visual symptoms, e.g. difficulty in reading, seeing the television screen, recognising faces or difficulty with night vision. Among maculopaths, 20.1% were aware of colour vision abnormality at baseline and 9.5% noted new central scotomata post-treatment. Of those with proliferative retinopathy, 13% had stopped driving due to poor eyesight and 19% noted new peripheral field defects post-treatment. Pre- and post-laser, 38.2% vs 47.3% of those with maculopathy and 44.4% vs 55.5% of those with proliferative retinopathy said their eyesight prevented them from doing things.¹⁵

It is important that patients understand that laser treatment is to prevent the vision from worsening – not to improve it.

Localised laser treatment may cause transient visual symptoms but does not usually cause significant visual loss. Pan-retinal laser therapy treatment often reduces peripheral vision, night vision and colour vision, and impairs central vision. Some patients have to stop driving.

Macular oedema

This can cause blurred vision and ultimately gaps in vision – scotomata. Antivascular endothelial growth factor (anti-VEGF) has revolutionised diabetic macular oedema management.¹⁶

Charles Bonnet syndrome

One Australian study found Charles Bonnet syndrome in 17.5% of people with visual acuity $\leq 6/12$.¹⁷

These visual release hallucinations are often simple, repeated patterns. More complex visual hallucinations of people (perhaps Lilliputian), objects or landscapes may frighten patients who think they are 'going mad'.

Practical issues

Diabetes self-care issues may include: food purchase and preparation; reading medication names and doses (especially insulin), health information, appointment letters; glucose monitoring; using IT or the phone. Patients may no longer be able to drive.

The Royal National Institute of Blind people (RNIB) provides useful help, including visual aids.¹⁸

Site	Potential eye problem(s)
Orbits	Fungal infections via sinus (rare)
Lids	Ptosis, inflammation
Eye muscles*	Mononeuropathy causing squint
Refraction	Changes or blurring – often fluctuate with glucose level
Tears	Dry eyes
Cornea	Reduced sensitivity, scratches, ulcers
Iris	Rubeosis iridis, neovascular glaucoma
Ciliary body	Premature presbyopia (long-sightedness)
Lens	Cataract, refraction problems
Vitreous	Posterior detachment
Retina	Diabetic retinopathy (haemorrhages, exudates, new vessels), lipaemia retinalis, arterial occlusion, central retinal vein occlusion, detachment
Macula	Maculopathy (exudates, ischaemia, oedema)
Intraocular pressure	Glaucoma
Optic nerve*	Swelling (papilloedema), optic atrophy, new vessels on disc

Note: rare syndromes, e.g. Wolfram's, may include diabetes and visual impairment

*Consider other causes.

Table 1. Eye problems in diabetes¹⁹

Summary

Visual problems are common among people with diabetes. They range from temporary (but still disabling) blurring caused by high or low glucose levels to permanent impairment of colour, depth, contrast, field and other visual functions. These changes may pre-date clinically obvious eye disease such as retinopathy. Visual loss can produce hallucinations.

Health care professionals are often unaware of how much, or how little, their patients can see, and how this affects their daily lives. Ask your patients if they have any difficulties with seeing.

In most diabetes services, the preponderance of older patients plus the many visual problems of diabetes (Box 1, Table 1) mean that all written and visual information should be in clear, large print.

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References

1. Leonie Watson. www.bbc.co.uk/news/disability-34847776 [accessed 31 July 2016].
2. TabbyL, et al. I want my old eyes back. www.diabetes.co.uk/forum/threads/i-want-my-old-eyes-back.102840/ [accessed 31 July 2016].

3. Kinnear PR, et al. The diabetic eye and colour vision. *Trans Ophthalmol Soc UK* 1972;92:69–78.
4. Fong DS, et al. Impaired color vision associated with diabetic retinopathy: Early Treatment Diabetic Retinopathy Study Report No. 15. *Am J Ophthalmol* 1999; 128:612–7.
5. Gella L, et al. Impairment of colour vision in diabetes with no retinopathy: Sankara Nethralaya Diabetic Retinopathy Epidemiology and Molecular Genetics Study (SNDREAMS-II, Report 3). <http://dx.doi.org/10.1371/journal.pone.0129391> [accessed 26 July 2016].
6. Lombrail P, et al. Abnormal color vision and reliable self-monitoring. *Diabetes Care* 1984;7:318–21.
7. Bresnick GH, et al. Urinary glucose testing inaccuracies among diabetic patients. Effect of acquired color vision deficiency caused by diabetic retinopathy. *Arch Ophthalmol* 1984;102:1489–96.
8. Shoji T, et al. Do type 2 diabetes patients without diabetic retinopathy or subjects with impaired fasting glucose have impaired colour vision? The Okubo Color Study Report. *Diabet Med* 2011;28:865–71.
9. Rodgers M, et al. Colour vision testing for diabetic retinopathy: a systematic review of diagnostic accuracy and economic evaluation. *Health Technol Assess* 2009;13(60):1–160.
10. Changizi MA, et al. Bare skin, blood and the evolution of primate colour vision. *Biology Letters* 2006 22 June. doi: 10.1098/rsbl.2006.0440 [accessed 31 July 2016].
11. Katz G, et al. Mesopic foveal contrast sensitivity is impaired in diabetic patients without retinopathy. *Graefes Arch Clin Exp Ophthalmol* 2010;248:1699–703.
12. Georgakopoulos CD, et al. Decreased contrast sensitivity in children and adolescents with type 1 diabetes mellitus. *J Pediatr Ophthalmol Strabismus* 2011;48:92–7.
13. Schwartz V. Diabetes-related complications, glycemic control, and falls in older adults. *Ann Diabetes Care* 2008;31:391–6.
14. Trick GL, et al. Visual field defects in patients with insulin-dependent and noninsulin-dependent diabetes. *Ophthalmology* 1990;97:475–82.
15. Bailey CC, et al. Visual symptomatology in patients with sight-threatening diabetic retinopathy. *Diabet Med* 2001;18:883–8.
16. NICE. Aflibercept for treating diabetic macular oedema. TA346. 2015. www.nice.org.uk/guidance/ta346 [accessed 31 July 2016].
17. Vukicevic M, et al. Butterflies and black lacy patterns: the prevalence and characteristics of Charles Bonnet hallucinations in an Australian population. *Clin Exp Ophthalmol* 2008;36:659–65.
18. www.rnib.org.uk/ [accessed 31 July 2016].
19. Hillson R. *Diabetes care: a practical manual*, 2nd edn. Oxford University Press, 2015; p270.

Diabetes vignette

And the best treatment for diabetes poor compliance is...

During a regular clinic visit to the paediatric endocrinologist, a 17-year-old male, with type 2 diabetes since the age of 15, admitted missing many of his required metformin and insulin doses and not checking his blood glucose at home as needed.

Physical examination revealed an obese patient with acanthosis nigricans on the neck and skin folds area. The patient's BMI was 32kg/m². Laboratory testing showed a haemoglobin A_{1c} level of 9.8% with no urinary ketones.

A review of the patient's diabetes management plan was performed; this discussed the importance of compliance with therapy to prevent future complications, and a follow-up appointment within one month was scheduled. The patient failed to show up for follow up, and he could not be reached by phone to schedule another visit.

Three months later, the patient showed up for a clinic visit, escorted by guards from the juvenile detention centre. Further history revealed that he was locked up there for two months due to a burglary attempt.

He was placed under a healthy diabetes diet, his blood glucose levels were checked appropriately, his BMI went down to 29kg/m² and his haemoglobin A_{1c} level was 7.1%.

The patient expressed that he felt better about his diabetes than at any time before.

Discussion

Providing diabetes care in prisons may not be easy due to self-manipulative behaviour by prisoners with diabetes.¹ However, a survey on the quality of diabetes care across UK prisons has identified some examples of good diabetes practices that include availability of diabetes protocol therapies and gathering of support groups.² Good diabetes control can be achieved in prisons due to a rigid dietary regimen, compliance with therapy and lack of alcohol consumption.³

The British Diabetic Association (now Diabetes UK) has published guidelines for the provision of diabetes care in British prisons.⁴ Similarly, the American Diabetes Association has published guidelines for the US.⁵ Self-monitoring of blood glucose and availability of focused workshops have been used as some modalities of diabetes care in prisons.^{6,7}

There are still some global challenges in diabetes care in prisons; these include lack of consultant and specialist nurse visiting to prisoners.⁸ Other challenges include recognising and managing hypoglycaemic

episodes and screening for complications of diabetes.²

Diabetes care in juvenile detention centres remains a problem due to the lack of experience in dealing with diabetes in youth. However, a good connection with the paediatric diabetes team can maximise outcomes.

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References

1. Gill GV, MacFarlane IA. Problems of diabetics in prison. *BMJ* 1989;298(6668):221–3.
2. Booles K. Survey on the quality of diabetes care in prisons across the UK. *J Diabetes Nurs* 2011;15(5): 168–76.
3. MacFarlane IA, et al. Diabetes in prison: can good diabetic care be achieved? *BMJ* 1992;304(6820):152–5.
4. MacFarlane IA. The development of healthcare services for diabetic prisoners. *Postgrad Med J* 1996; 72(846):214–7.
5. American Diabetes Association. Diabetes management in correctional institutions. *Diabetes Care* 2014;37(1):S104–11.
6. Hunter Buskey RN, et al. The effect of blood glucose self-monitoring among inmates with diabetes. *J Correct Health Care* 2015;21(4):343–54.
7. Davoust S, et al. The impact of medication-focused workshops in a diabetes educational program in jail: a pilot study. *Int J Clin Pharm* 2016;38(2):203–7.
8. Petit JM, et al. Management of diabetes in French prisons: a cross-sectional study. *Diabet Med* 2001;18(1):47–50.