

# Keratomalacia on a 'healthy diet'

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**SUMMARY** The case is described of a 39-year-old man with previously undiagnosed chronic schizophrenia and with bilateral keratomalacia secondary to his bizarre diet. He presented with a perforation of the right cornea which required an emergency penetrating keratoplasty. The difficulties of clinical management of a patient with an overt psychosis and the use of serum retinol levels to monitor treatment are described. Causes of vitamin A deficiency seen in Great Britain are discussed.

Vitamin A deficiency is common throughout the world in general but is rarely seen in the United Kingdom. It is closely associated with protein energy malnutrition,<sup>1</sup> and it arises when the diet contains practically no whole milk or butter and very limited amounts of fresh vegetables or fruit, therefore lacking both retinol and carotenes. The disease is almost unknown in Europe today, but an outbreak in Denmark during the first world war is instructive.<sup>2,3</sup> It occurred despite the fact that Denmark had very large dairy herds, so that ample supplies of Vitamin A should have been available. However, because most of the butter was exported to Germany, the poor could obtain only separated milk and lived on a diet of oatmeal gruel and barley broth. Some 700 children were affected of which 400 had keratomalacia. In 1918 a weekly ration of butter was issued and the disease disappeared.

A case of bilateral keratomalacia and endophthalmitis with a right perforated cornea is described. The patient was a previously undiagnosed chronic schizophrenic. He had been observing a strict vegan diet for seven years, resulting in severe nutritional deficiencies (a vegan is an extreme vegetarian, who consumes no animal food or dairy products whatever).

## Case report

**History and examination.** This 39-year-old Caucasian male was admitted as an emergency with a marginal perforation of the right cornea. He had been 'worried' about his eyes for the previous five days, complaining of photophobia, watering, discharge,

and deterioration of visual acuity. He denied any problems with night vision but admitted that for four months he had become a recluse, staying in his room with the lights off and finding his way around by touch. During the five days prior to presentation he described two episodes of profuse watering from the right eye.

His general appearance was unkempt and emaciated and he appeared severely malnourished. His visual acuity was reduced in each eye to counting fingers. Examination was hampered by his excited and uncooperative state as well as his severe photophobia and discomfort. He refused to be examined at the slit-lamp. His lids were erythematous and oedematous, with a marked purulent discharge. His conjunctivae were chemosed and severely injected, with dry keratinised epithelium typical of xerophthalmia. The corneae were of ground glass appearance. The right cornea had a superior marginal perforation with an iris prolapse, a flat anterior chamber, and a hypopyon. The left cornea had a similarly placed desmetocoele, containing sloughed material, a formed anterior chamber, and a hypopyon. There was a second smaller ulcer near the centre of the left cornea. The above findings precluded a clear fundal view.

General examination revealed widespread skin lesions which were pigmented and keratinised, with follicular plugging.

His mental state was assessed by the psychiatrists, who confirmed a diagnosis of chronic schizophrenia, with 'knight's move' thought disorder and autochthonous delusions.

Further inquiry revealed that he had eaten a strange diet. He believed that poisons entered the

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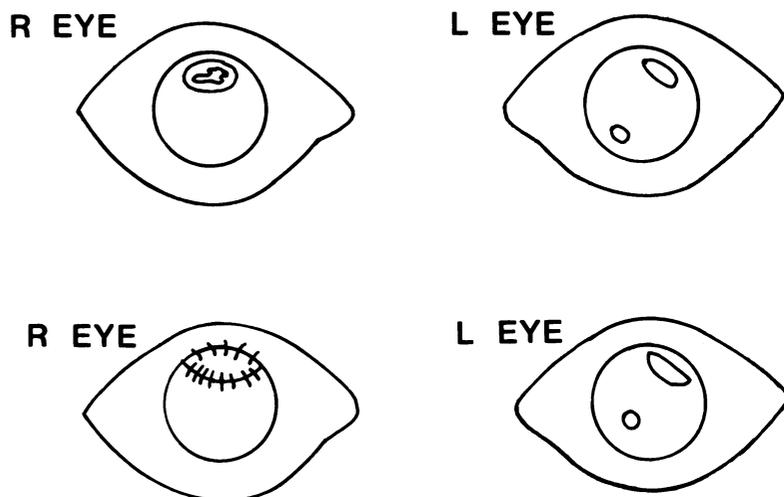


Fig. 1 Above: Preoperative appearance of corneae showing position of right perforation and left desmetocoele and ulcer. Below: Postoperative appearance of corneae showing position of right penetrating keratoplasty and confirming findings in the left eye.

body in our food and that a 'good' diet was essential to maintaining good health. He had therefore become a vegetarian in the 1960s and in 1977 had become a strict vegan. In addition to excluding all animal and dairy produce he had completely avoided even vegetables and fruit for seven years. His diet consisted of partially cooked brown rice, pulses, and sprouting alfalfa, all very low in vitamin A and carotenoids. He believed that this was a well balanced diet and included all essential nutrients. On admission he weighed 55 kg, and after two months' inpatient stay on a high protein, high calorie diet he weighed 75.5 kg.

**Immediate management.** Examination under anaesthetic confirmed our earlier findings. We carried out an emergency right upper segment penetrating keratoplasty. The edges of the ulcer around the area of perforation were very friable and had to be excised to allow secure suturing of fresh donor material to make good the defect (Fig. 1).

**Investigations.** Culture of conjunctival swabs from each eye grew *Haemophilus influenzae* and commensals. Serum retinol,  $\beta$ -carotenoid, retinal binding protein, and prealbumin were extremely low. There was evidence of generalised malnourishment with a very low vitamin D and fasting triglyceride and cholesterol levels. Vitamin B<sub>12</sub>, vitamin C, zinc, and copper were all at the lower limit of normal (Table 1). Other workers have suggested that electroretinogram (ERG) and dark adaptation tests are useful in monitoring this condition (see Discussion), but unfortunately our patient would not co-operate with any of these investigations. Nor would he allow us to photograph him.

**Treatment.** Postoperatively the endophthalmitis was treated with systemic ampicillin and flucloxacillin

orally, 500 mg of each four times a day, and intensive topical antibiotics, gentamicin and chloramphenicol eye drops hourly initially, with atropine cycloplegia. He required three subconjunctival injections of methicillin and gentamicin on three consecutive postoperative days. Four days after operation topical steroids were introduced for uveitis and vitritis. He remained on systemic antibiotics for three weeks, and topical treatment was gradually reduced over eight weeks.

A regimen of vitamin A replacement therapy was started, and the serum levels monitored at intervals (Table 2, Fig. 2). After much persuasion he agreed to take a high protein, high calorie vegan diet with additional multivitamins.

**Progress.** The patient's eyes rapidly improved on vitamin A replacement therapy. The corneal haze cleared over two weeks. Five months after presenta-

Table 1 Biochemical investigations on admission

	Serum level	Normal range
Retinol	0.56 $\mu$ M	2.13–4.64 $\mu$ M
Carotene	0.20 $\mu$ M	0.6–4.64 $\mu$ M
Retinol binding protein	16 mg/l	36–84 mg/l
Pre-albumin	70 mg/l	269–405 mg/l
Vitamin D (25-hydroxycholecalciferol)	0.3 ng/l	8–50 ng/l
Vitamin B <sub>12</sub>	170 ng/l	120–600 ng/l
Folate	7.4 $\mu$ g/l	1.6–6.0 $\mu$ g/l
Zinc	9.8 $\mu$ mol/l	8–17 $\mu$ mol/l
Copper	12.5 $\mu$ mol/l	13–27 $\mu$ mol/l
Magnesium	0.83 mmol/l	0.7–1.2 mmol/l
Total protein	52 g/l	60–80 g/l
Albumin	34 g/l	34–45 g/l
Calcium	2.13 mmol/l	2.26–2.0 mmol/l
Fasting triglyceride	0.3 mmol/l	0.8–2.0 mmol/l
Fasting cholesterol	1.2 mmol/l	2.5–8.8 mmol/l

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Table 2 Serum levels of retinol in response to vitamin A therapy

	Retinol levels, $\mu\text{mol/l}$
Normal range	2.13-4.64
On admission	0.56
1 week	1.3
2 weeks	2.3
5 weeks	2.6
12 weeks	1.6

tion his visual acuity had improved to R 6/18, L 6/12. His eyes were white and uninfamed, with an opaque but avascular right superior corneal graft, a similarly placed left corneal scar, and a small scar close to the left visual axis. He refuses to wear glasses to correct the right astigmatism (induced by the graft), though correction improves the visual acuity to 6/9. Fundus examination is almost impossible, as he develops intense blepharospasm on attempted ophthalmoscopy.

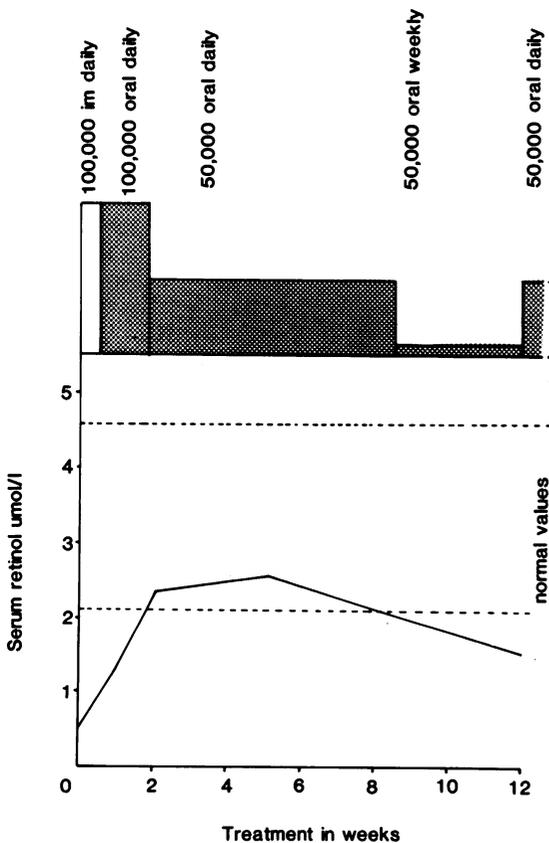


Fig. 2 Serum retinol levels in response to treatment.

## Discussion

Vitamin A deficiency<sup>4</sup> can cause nyctalopia, xerophthalmia, and keratomalacia. Night blindness was recognised in ancient Egyptian and Chinese writings in 1500 BC and was treated with liver, which is rich in vitamin A. It was also well known to the Greek and Roman physicians.

Keratomalacia is recorded in children in the industrial slums of nineteenth century Europe. By the early twentieth century it was rare, occurring only in isolated outbreaks such as the one in Denmark during the first world war.

Today vitamin A deficiency, xerophthalmia, and keratomalacia are rare in Western developed countries, but in many parts of the world keratomalacia is a major cause of blindness in children, particularly in Asia, certain parts of West Africa, the Middle East, Brazil, and Haiti. In these countries it is closely associated with protein malnutrition. A low dietary intake, compounded by hypoproteinaemia, results in a low level of retinol binding protein required to transport retinol in the plasma, while chronic intestinal infections and diarrhoea impair absorption of vitamin A and carotenoids.

Severe protein malnutrition is rare in the Western developed countries. Nyctalopia, the less severe form of vitamin A deficiency, occurs occasionally in malabsorption syndromes<sup>5,6</sup> (short bowel syndromes in Crohn's disease and following resection for obesity) and severe liver disease,<sup>7</sup> where it is often subclinical, detected only on dark adaptation testing<sup>8,9</sup> or ERG.<sup>10,11</sup> In the UK there is compulsory enrichment of margarine with vitamin A (approx. 800 IU/ounce=28 IU/g) and voluntary enrichment of skimmed milk powder. Therefore elderly people are unlikely to be at risk unless severely protein malnourished.

Keratomalacia has been reported<sup>12</sup> in an adult in the United States who had voluntarily eliminated all fresh fruit and vegetables from her diet in order to reduce exacerbations of her ulcerative colitis, and in a young man who deliberately eliminated all food containing vitamin A from his diet for five years in order to prevent his grand mal epilepsy.<sup>13</sup> Both these patients were psychologically disturbed.

The patient reported on here was severely malnourished, as substantiated by biochemical investigation (Table 1). The ocular findings were consistent with keratomalacia and secondary bacterial infection. The yellow punctate retinopathy seen in the case of Bors and Fells<sup>13</sup> was not observed, because even when the ocular media had cleared the patient developed acute blepharospasm on attempted fundal examination.

Particular problems were encountered in managing his chronic schizophrenia. It was difficult to obtain a clear history and to explain treatments, for he would embark on lengthy discussions, departing at tangents to the argument. He required a lengthy inpatient stay because he could not be relied on to continue his treatment or diet at home. In the investigation of this patient's ocular condition complicated tests were unhelpful. Dark adaptation tests or ERGs could not be performed as he would not co-operate. These tests might have been helpful in assessing progress if they had been possible, but in the circumstances his clinical course could be monitored only by external clinical examination and regular estimations of serum retinol levels. It seems likely, however, that most patients who develop vitamin A deficiency to this degree in Western countries are psychologically disturbed, so that the practicability of investigations requiring the patient's co-operation may be in doubt. Dark adaptation testing has been shown to be valuable in detecting subclinical deficiency of vitamin A in chronic alcoholism, primary hepatic disease, and chronic small intestinal disease. ERGs have a limited clinical use in detection only, as the abnormality of the a and b waves is of long duration even with a return to normal retinol levels, and therefore cannot be used as a therapeutic indicator.

Most Western ophthalmologists lack clinical familiarity with the ocular signs of vitamin A deficiency. They should be alert to a possible nutritional deficiency in a patient with unusual external ocular signs who may have a self induced nutritional deficiency, as in this case.

I thank Mr Peter Graham for allowing me to report this case. I am also grateful to Dr Max Harper, honorary consultant psychiatrist, and his colleagues for their advice with the psychiatric diagnosis and management of this patient.

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