CASE REPORTS

Rare Optic Neuropathy in a Jamaican Couple Linked to Cassava Root Consumption

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ABSTRACT

We report central visual loss with selective papillomacular bundle damage in a Jamaican couple, husband and wife, with long-term cassava root consumption. The two cases presented independently with gradual central visual loss. Examination revealed bilateral temporal pallor of the optic nerve head and automated static perimetry demonstrated a central or caecocentral scotoma in each patient. Optical coherence tomography findings are described. The only mutual risk factor, reported independently, was long-term cassava consumption. Cessation of cassava intake and vitamin supplementation resulted in partial recovery of visual function. As thiocyanate levels in urine were not measured, the aetiology in these patients is not definitively confirmed, but chronic cassava consumption should be considered in similar cases as a rare cause of potentially reversible optic neuropathy.

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Introduction

Cassava root is a staple food for almost 500 million people worldwide, especially in tropical and subtropical Africa.¹ There are many different varieties of cassava, but the bitter types such as *gari* and *manihot esculenta* are known to produce linamarin, which is a cyanogenic glycoside, and the literature has shown that inadequate processing of the cassava root can lead to high levels of cyanide ingestion.² Reports on cassava root-induced toxicity involving solely the optic nerve are few, but describe decreased visual acuity (VA) and colour vision and optic atrophy.³ Although optic neuropathy from cassava has been reported previously, this is the first report to our knowledge that identifies the particular patterns of retinal nerve fibre layer (RNFL) loss on optical coherence tomography (OCT) and retinal ganglion cell (RGC) complex changes in a non-consanguineous couple.

Case reports

A 67-year-old male with a past medical history of hypertension, right-sided renal angiomyolipoma, and past ocular history of prior bilateral cataract

surgery, presented with a 1-year history of gradually worsening vision in both eyes, described as blurring of central vision with clear peripheral fields. He denied photophobia, pain with eye movements, and diplopia. He had emigrated from Jamaica 30 years ago and worked as an auditor. He denied alcohol, tobacco, or other recreational drug use. He followed a vegetarian diet and had received B12 vitamin supplementation in the past. On examination, his VA was 20/80 in each eye with colour vision (Ishihara) 3/11 in the right eye and 4/11 in the left. Pupils constricted briskly from 4 mm to 2 mm without an afferent pupillary defect. He had full motility and full confrontational peripheral visual fields bilaterally. Slit lamp examination was unremarkable. Funduscopy showed blunted foveal reflexes bilaterally. Optic nerve exam was unremarkable in both eyes. OCT and Humphrey visual field testing 24–2 (HVF) were also performed: although OCT of the RNFL was unremarkable, HVF showed mild central scotoma in both eyes (not shown).

Five months later, the patient's 60-year-old wife presented with worsening vision in both eyes for the past year. Her past medical history was significant for breast cancer status-post bilateral mastectomy in

2009, on maintenance tamoxifen. She had also emigrated from Jamaica with her husband 30 years ago. On examination, her VA was 20/200 in each eye with colour vision 6/11 in the right eye and 5/11 in the left. Pupils were equal, round, and reactive to light and without an afferent pupillary defect. She had full motility and full confrontational visual fields bilaterally. Slit lamp examination was unremarkable. Funduscopy showed mild optic nerve temporal pallor bilaterally (Figure 1). HVF and Goldmann visual field analysis showed central scotoma OS (left eye) and

caecocentral scotoma OD (right eye) (Figures 2 and 3); OCT demonstrated focal temporal thinning of the RNFL with normal average thickness and diffuse RGC loss bilaterally (Figure 4). Extensive work-up was performed including nutritional panel testing (vitamins B1, B12, folate), toxicity panel (mercury, copper, lead), and magnetic resonance imaging, which were all unremarkable. Urinary thiocyanate levels were not measured.

Given the similar optic neuropathy with central visual field defect in non-consanguineous

Figure 1. Funduscopy shows mild optic nerve temporal pallor bilaterally in a 60-year-old, married, cohabitating female after chronic consumption of cassava.

Figure 2. Humphrey visual fields show central scotoma in the left eye and caecocentral scotoma in the right eye.

Figure 3. Goldmann visual fields confirm central scotoma in the left eye and caecocentral scotoma in the right eye.

Figure 4. Optical coherence tomography (OCT) of the retinal nerve fibre layer shows normal average thickness with focal temporal thinning in both eyes, representing a papillomacular bundle injury. OCT of the retinal ganglion cell (RGC) complex shows diffuse RGC loss in both eyes.

couple, a thorough discussion of lifestyle was undertaken independently with each patient to evaluate for possible causes of toxic optic neuropathy. The only mutual risk factor reported by each patient was a mean consumption of approximately 10 bitter cassava-based meals per week for at least the past decade. Both patients were advised to stop eating cassava and were treated with intramuscular injections of vitamin B12, and vitamin B1, oral folate, and multivitamin supplementation. Within 6 months VA had improved from 20/200 to 20/80 in the wife and 20/80 to 20/40 in the husband. However, for both patients OCT-RNFL and RGC complexes did not show recovery, But continue to deteriorate slightly in both patients.

Discussion

Cassava-related optic neuropathy is a rare cause of optic neuropathy with central visual field defect, which is partially reversible if treated early. It is more common in persons from Africa, India and Jamaica who have chronic intake of Cassava for many years. Differential diagnoses include compressive, nutritional, hereditary, or other causes of toxic optic neuropathy.

In our patients, husband and wife, OCT-RNFL and RGC complex showed direct evidence of injury to the papillomacular (PM) bundle, which is consistent with the central and caecocentral scotoma seen with visual field analysis. Our study is most consistent with a prior study by Zebulun

et al. that described 10 patients with central or caecocentral scotoma and bilateral temporal RNFL loss on OCT, presumed secondary to cassava toxicity.³ Patients experienced an onset of visual symptoms with an average of 22.7 years after consuming a mean of 2.57 cassava-based meals per week. OCT-RNFL showed marked temporal thinning in all patients with preservation of other sectors, consistent with our cases. No patients were related or cohabitating in their study. We did not test urinary thiocyanates and therefore we cannot definitively attribute our patient's symptoms to cassava consumption. We strongly suspect cassava-induced optic neuropathy, however, given the mutual history of cassava intake, the visual recovery after cessation of cassava intake, and the similarities to this prior study.

Compared to hereditary optic neuropathy,⁴ cassava-induced optic neuropathy demonstrates poor VA, but better-preserved nerve fibre layer with a normal average thickness with focal mild temporal thinning due to PM bundle damage. This mild structural damage in early stage probably accounts for the reversibility of this disease with cessation of cassava intake and vitamin supplement treatment: although RGC and RNFL do not appear to recover, VA improves. Interestingly, HVF showed improvement of the central/caecocentral scotoma in both eyes of both patients. In our study, we observed visual functional improvement after treatment, but OCT-RNFL and RGC complex continue to get worse, which has been noted in the disease process of many other optic neuropathies.

We report a couple presenting with partially reversible optic neuropathy, likely due to cassava toxicity, without any evidence of neurological disorder. This differs from previous epidemics of optic neuropathy, which are more likely to also involve peripheral nerves. In Tanzania, 38 young African adults presented with decreased vision, and nearly half (47%) of these patients had an associated peripheral neuropathy. Uniformly low levels of urinary thiocyanate were measured as a major biomarker of cyanide intake to distinguish this entity from the suggested relationships of other irreversible neurological syndromes in Africa such as Konzo and tropical ataxic neuropathy.⁵ A similar pattern of optic and peripheral neuropathy was epidemic in Cuba in the early 1990s, afflicting approximately

50,000 people before initiation of vitamin supplementation decreased the number of cases. This phenomenon had three clinical manifestations: bilateral optic neuropathy with caecocentral scotomas, peripheral neuropathy, or mixed optic and peripheral neuropathy, likely related to nutritional deficiency.⁶ The clinical findings of co-existing optic and peripheral neuropathy are similarly present in Strachan syndrome with accompanying sensorineural deafness and mucocutaneous lesions, originally described in the tropics and later in malnourished war prisoners.⁷ Later reports of variations to Strachan syndrome arose, one such report in London described two patients of Afro-Caribbean origin without evidence of mucocutaneous lesions or malnourishment.⁸

The precise mechanism of toxic optic neuropathy due to cassava consumption is still unknown, and may be linked to the poor nutritional value of cassava or directly to cyanide neurotoxicity, although this can only be directly measured with urinary thiocyanate levels. Our report is the first to show toxic optic neuropathy in a cohabitating couple without other systemic symptoms, supporting previous thought that intake of cassava independent of hereditary factors may cause significant damage to the optic nerve alone, without peripheral involvement. Awareness of this potential result of chronic cassava consumption is crucial in establishing a timely diagnosis of this potentially reversible disease at an early stage.

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References

1. Yusuf AZ, Zakir A, Shemau Z, Abdullahi M, Halima SA, Sani K. Visual defects among consumers of processed cassava (gari). *Afr J Food Sci*. 2014;8:25–29. doi:10.5897/AJFS.
2. Aregheore EM, Agunbiade OO. The toxic effects of cassava (*manihot esculenta* grantz) diets on humans: a review. *Vet Hum Toxicol*. 1991;33(3):274–275.
3. Zeboulon P, Vignal-Clermont C, Baudouin C, Labbe A. A rare cause of optic neuropathy: cassava. *J Fr Ophthalmol*. 2016;39(6):506–514. doi:10.1016/j.jfo.2016.02.009.
4. Tr H, Gobuty M, Ra M, Erlich-Malona N, Monaco C, Ce M-S. The optical coherence tomographic profile of

- Leber hereditary optic neuropathy. *Neuroophthalmology*. 2016;40(3):107–112.
5. Plant GT, Mtanda AT, Arden GB, Johnson GJ. An epidemic of optic neuropathy in Tanzania: characterization of the visual disorder and associated peripheral neuropathy. *J Neurol Sci*. 1997;145(2):127–140.
 6. Thomas PK, Plant GT, Baxter P, Bates C, Santiago Luis R. An epidemic of optic neuropathy and painful sensory neuropathy in Cuba: clinical aspects. *J Neurol*. 1995;242(10):629–638.
 7. Hedges TR 3rd, Hirano M, Tucker K, Caballero B. Epidemic optic and peripheral neuropathy in Cuba: a unique geopolitical public health problem. *Surv Ophthalmol*. 1997;41(4):341–353.
 8. Cockerell OC, Ormerod IE. Strachan's syndrome: variation on a theme. *J Neurol*. 1993;240(5):315–318.