An Unusual Case of Bilateral Multifocal Retinal Pigment Epithelial Detachment with Methanol-Induced Optic Neuritis

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Abstract

Purpose To describe an unusual case of methanol-induced optic neuritis with bilateral multifocal extrafoveal serous retinal pigment epithelial (RPE) detachment.

Methods Single case report.

Case Report A 40-year-old male presented with acute bilateral loss of vision and history of consumption of adulterated alcohol. On examination, his vision was perception of light in the right eye and finger counting at 1-ft distance in the left eye. Pupillary reactions were sluggish. The optic discs were normal. An elevated lesion with subretinal serous fluid was present over macula adjacent to superior major vessel arcade in the right eye, which was confirmed as a large extrafoveal RPE detachment on fluorescein angiography. There were two more small RPE detachments in the right eye as well as in the left eye. All RPE detachments were extrafoveal in location. The patient was managed medically with intravenous methylprednisolone (1 g) in 500 ml of ringer lactate for three consecutive days. After three doses, visual acuity of both eyes was recorded as 20/20.

Conclusion We herein report an unusual case of bilateral multifocal extrafoveal serous RPE detachment in a patient of methanol-induced optic neuritis. RPE detachments may be due to the toxic effect of methanol metabolites.

Keywords Methanol · Retinal pigment epithelial (RPE) Detachment · Optic neuritis · Methylprednisolone

Introduction

Methanol poisoning is a common problem in many parts of the developing world. It usually results from either accidental

ingestion of methanol or by drinking adulterated ethanol. In the body, methanol is metabolised by an enzyme alcohol dehydrogenase into formaldehyde, which is subsequently metabolised by aldehyde dehydrogenase into formic acid, causing metabolic acidosis. Toxicity results from the combined effect of metabolic acidosis and an intrinsic toxicity of formate anion itself [1]. Acute methanol poisoning is characterised by visual symptoms e.g., photophobia, blurred vision, visual field deficit and visual loss, appearing after an initial mild central nervous depression followed by an asymptomatic latent period of 12–24 h [2, 3].

Optic neuritis with or without optic disc and retinal swelling is the main mode of presentation of methanol poisoning [3–6]. Herein we report a case of acute methanol-induced optic neuritis presenting with visual loss and bilateral multifocal extrafoveal serous retinal pigment epithelial (RPE) detachment.

Case Report

A 40-year-old male was brought to an ophthalmic outpatient department with complaint of sudden bilateral loss of vision. He was having no other symptoms. His detailed history revealed consumption of about 200 ml of local-made alcohol on the previous day in the morning. After a few hours, he became delirious and fell asleep. On awakening in the evening, he noticed a profound loss of vision in both his eyes.

On general examination, the patient was conscious, cooperative, and well oriented to time, place, and person. His general condition was good with a pulse rate of 84/min, respiratory rate of 20/min and blood pressure of 124/86 mm of Hg. On ophthalmic examination, right eye vision was perception of light only with accurate projection of rays and left eye vision was finger counting at 1 ft. Both pupils were mid-dilated and reacted sluggishly to light. Both optic discs were normal in appearance. In the right eye, an elevated lesion with subretinal serous fluid was noticed over the macula near superior temporal vessel

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arcade. On fluorescein angiography it was confirmed as a large extrafoveal RPE detachment. There were two more small RPE detachments in the right eye as well as in the left eye. All RPE detachments were extrafoveal in location (Figs. 1 and 2). Optical coherence tomography (OCT) was unaffordable to patient.

Based on presenting symptoms and history of alcohol intake, the patient was admitted as a case of bilateral retrobulbar optic neuritis owing to suspected methanol poisoning. On investigations, his serum methanol level was 18 mg/dl and methanol ingestion was confirmed. His complete blood count, blood sugar, liver function tests, and kidney function tests were within normal limits [Table 1]. Serum electrolyte values were not available, however, signs of systemic toxicity were ruled out by an internal medicine consultation.

For the treatment of visual loss due to optic neuritis, the patient was administered intravenous methylprednisolone (1 g) in 500 ml of ringer lactate slowly over 4 h on three consecutive days. After three doses of intravenous methylprednisolone, the patient had complete visual recovery (oculus uterque (OU) 20/20). The patient was discharged on oral prednisolone (1 mg/kg body weight) with recommended follow-up at 10 days, but was lost to follow-up.

Discussion

Formic acid, a metabolic derivative of methanol, is responsible for systemic and ocular toxicity seen in methanol poisoning. Systemic effects are mainly due to metabolic acidosis resulting from accumulation of formic acid. Ocular toxicity is thought to be due to a direct effect of the formate anion, which is thought to cause interruption of mitochondrial function, mainly in the retrolaminar or retrobulbar portion of optic nerve resulting in optic neuritis and consequently in loss of vision [1, 7]. Ocular symptoms usually appear after a latent period of 12–24 h following methanol ingestion [2, 3]. The level of toxicity does not correlate with the serum methanol level and hence, is not considered a good indicator of prognosis [1].

Optic neuritis, either retrobulbar or neuroretinitis, is the well-reported mode of presentation in cases of acute methanol poisoning [3–6]. Presently established treatment modalities for

methanol poisoning include the use of specific antidotes like ethanol and fomepizole, use of folinic acid to enhance the metabolism of already formed formic acid, and use of sodium bicarbonate for correction of metabolic acidosis [1, 6]. These treatment modalities mainly prevent the formation of formic acid and further toxicity, but do not have any effect on established ocular toxicity [6]. There is no definitive treatment for methanol-induced optic neuritis, however, there are some studies reporting the use of intravenous methylprednisolone, resulting in good visual outcome [6–8]. In a case series of 17 patients of methanol-induced optic neuritis, Shukla et al. used intravenous methylprednisolone for 3 days followed by oral prednisolone, which resulted in a significant visual improvement in all of the patients except one [6]. In the Optic Neuritis Treatment Trial, a prospective, multi-centred clinical trial in which patients with acute unilateral optic neuritis were randomised to receive intravenous corticosteroids, oral corticosteroids, or oral placebo, it was found that visual function recovered more quickly in patients receiving intravenous methylprednisolone as compared to other groups [9, 10]. In our case, the patient presented with retrobulbar optic neuritis was treated with intravenous methylprednisolone following the dosing used in these studies. The treatment resulted in complete recovery of vision to 20/20 OU.

At presentation, the patient also had bilateral multifocal extrafoveal serous RPE detachments of both eyes. RPE detachment is defined as separation of RPE cell layer, the outermost layer of retina, from the underlying Bruch's membrane, the innermost layer of choroid, due to presence of blood, serous exudates, drusen, or a neovascular membrane in between these two [11]. Pathophysiologically, RPE detachment results from disruption of the normal junctions between basement membrane of RPE and the inner collagenous layer of Bruch's membrane, permitting serous fluid to gain access into the sub-RPE space. Age-related macular degeneration, choroidal neovascular membrane, high myopia, angioid streaks, hereditary choroidal degeneration, primary ocular histoplasmosis syndrome, and choroidal tumours have all been identified as precipitating conditions in development of RPE detachment. Idiopathic cases of RPE detachment are also seen sometimes with central serous chorioretinopathy [12,

Fig. 1 Right eye—colour fundus photograph showing a large RPE detachment (black arrow) and fluorescein angiography image showing multiple hyperfluorescent spot (white arrows) corresponding to RPE detachment

Fig. 2 Left eye—colour fundus photograph showing a large RPE detachment (*black arrow*) and fluorescein angiography image showing multiple hyperfluorescent spot (*white arrows*) corresponding to RPE detachment

[13]. Ophthalmoscopically, RPE detachments are seen as well-circumscribed, round or oval, dome shaped, slightly elevated and yellow to orange colour lesions. During fluorescein angiography, the sub-RPE space fills progressively with dye resulting in early hyperfluorescent spots, which remain hyperfluorescent throughout the angiogram [13, 14]. In our patient, the presence of multifocal RPE detachment was confirmed by typical features of lesions present in posterior fundus seen ophthalmoscopically as well as by fluorescein angiography. Our patient did not appear to have another condition known to cause RPE detachment, raising the possibility that these lesions were a result of methanol poisoning.

We performed a literature search of ‘PubMed’ and ‘Google Scholar’ databases, and could find no other reports of multifocal RPE detachment due to methanol poisoning. On the basis of clinical features and electrophysiological tests, studies have reported that methanol affects not only the optic nerve but also retinal cells such as RPE, photoreceptors, and Müller

cells [15]. Experimental studies have also reported the toxic effect of formate on RPE cells and photoreceptors [2, 3, 16–18]. Seme et al. showed that cultured cell lines from both photoreceptors (661W) and RPE cells (ARPE-19) were sensitive to methanol-derived formate-induced cytotoxicity [18]. The direct toxic effect of formate results in histopathologic changes in outer retina, e.g. enlarged retinal subspaces, focal RPE detachment, areas of cone degenerations seen on light microscope and degeneration or vacuolation of RPE cells and loss of apical microvilli seen on electron microscopy [2, 3, 16, 17]. These studies and the lack of a known precipitating condition support our observation that RPE detachments in this case was due to methanol poisoning.

In most instances, serous detachment of the RPE occurs asymptotically. But, if macula is affected, then patients present with blurred vision, metamorphopsia, micropsia or positive scotoma. Visual prognosis is poorer if there is foveal involvement. Uncomplicated serous detachment of RPE often resolves spontaneously, however, RPE detachments associated with more generalised damage may be complicated by RPE tears, neovascularisation, haemorrhage, disciform scarring and RPE atrophy leading to visual loss within days to months or after several years. For RPE detachment with neovascularisation, various treatment modalities including focal laser photocoagulation and intravitreal anti-vascular endothelial growth factor are being evaluated, but in general, complicated cases are usually refractory to treatment [12–14]. In this case, multifocal RPE detachments were relatively asymptomatic due to extrafoveal location of lesions. Patient was advised to have a follow-up examination at 10 days to monitor the course of these RPE detachments, however, he was lost to follow-up.

In this case report, however, the possibility of RPE detachments as pre-existing condition cannot be ruled out completely due to lack of prior fundus record. The lack of visual field test, OCT, and the follow-up examinations are other limitations of this case report.

Conclusion

On the basis of the findings of this case report and related discussion, it can be concluded that multifocal RPE detachments

Table 1 Values of different investigations performed

Haemoglobin	12.6 g/dl
RBC count	4.29 million/ μ l
Total leukocyte count	9,060/ μ l
Differential leukocyte count	
Neutrophil	65.9 %
Lymphocyte	26.5 %
Monocyte	3.4 %
Eosinophil	4.0 %
Basophil	0.2 %
Random blood sugar	121 mg/dl
Serum total protein	6.9 g/dl
Serum albumin	4.2 g/dl
Serum total bilirubin	0.45 mg/dl
Serum direct bilirubin	0.30 mg/dl
Serum aspartate transaminase	40 U/L
Serum alanine transaminase	17 U/L
Serum alkaline phosphatase	109 U/L
Blood urea nitrogen	11.7 mg/dl
Serum creatinine	0.89 mg/dl
Serum methanol	18 mg/dl

may be part of the fundus picture in case of acute methanol poisoning. The RPE detachments may be the manifestation of toxic effect of methanol-derived formate on outer retina, especially RPE cells and photoreceptors. The RPE detachment may resolve spontaneously, but monitoring of these lesions is a must to avoid development of any complication.

Declaration of Interest The authors report no declarations of interest or funding support.

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