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Rare disease

Palinopsia from a posteriorly placed glioma – an insight into its possible causes

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Summary

Palinopsia is a distortion of processing in the visual system in which images persist or recur after the visual stimulus has been removed. It is a dysfunction of the association areas at the junction of temporal, occipital and parietal lobes and can be triggered by any lesion or dysfunction in this region. Here, the authors report the case of a patient with a glioma involving this region of the brain, who presented with palinopsia that subsequently disappeared once the tumour was surgically debulked. In the few cases of palinopsia that have been published so far, no such case has ever been reported. Furthermore, we took an insight into this rare and elusive phenomenon's causes and suggested Bayesian inference as a possible cause. The authors also mentioned visual evoked potentials as a useful test to be considered in future palinoptic patients.

BACKGROUND

Palinopsia (Greek *palin*, again and *opsis*, vision) is a distortion of processing in the visual system in which images persist or recur after the visual stimulus has been removed.¹

² In palinopsia, the illusory image often becomes incorporated appropriately into the visual scene being perceived; for example, in a famous case reported by Meadows, a Santa Claus beard became superimposed appropriately upon the faces of people at a party.³

Palinopsia is a symptom distinct from the physiological after-image in which images of an object persist or reappear after the person has stopped looking at the object.^{1 4} ⁵ Differences include the fact that palinoptic images have an interval between the original stimulus and the appearance of the after-image and are the same colour as the original object.^{2 6} They are also constant in size regardless of the distance of the background and their intensity is independent of the intensity of the stimulus.⁶ The image itself is usually of an object seen in the patient's immediate environment, and does not relate to a more distant visual experience.⁷

Palinopsia typically localises to a lesion in the non-dominant occipitotemporal cortex,⁸ though functional MR data have suggested its origin in parietal cortical projections to the occipital cortex.⁹ Its mechanism is uncertain, the most likely possibilities being a visual seizure, cerebral hyperperfusion adjacent to areas of cortical damage,¹⁰ following drug use or a release hallucination in cases where there is visual loss.¹¹

Here, we report the case of a patient with a glioma involving the junction of the parietal, temporal and occipital lobes, who presented with palinopsia, which then subsequently disappeared once the tumour was surgically

debulked. In the few cases of palinopsia that have been published so far, no such case has ever been reported. Furthermore, we felt it was necessary to take an insight into this rare and elusive phenomenon's causes and this would be a valuable addition to the literature on the topic. We also suggested Bayesian inference as a possible cause of palinopsia.

CASE PRESENTATION

History

A 73-year-old right-handed, retired accountant presented to us with a 2-week long history of visual disturbances in the left side of his vision. He seemed to have missed the words and numbers in his left visual field while reading. Also in his left visual field, he described seeing a persistent image of his wife long after she had left the room that they were in. The image of his wife was in normal colours and was extremely realistic down to the finest details, so much so that he even spoke to the image thinking it was real. Also, he had seen the image of his television in his left visual field, a few minutes after he had left his TV room to go to bed. Both these palinoptic images persisted for about 15 min, and were only visible in his left visual field. They eventually disappeared on their own.

Accompanying his visual field problems was a right frontal headache for the past week. He had been urgently referred to us in the Neurology Day Investigation Unit in keeping with his unusual symptoms. His headache was worse on bending forward and 'pressure-like' in character. It was also slightly worse on waking and had not been relieved by acetaminophen or codeine. In his medical history, he was a known case of diabetes mellitus type 2, well

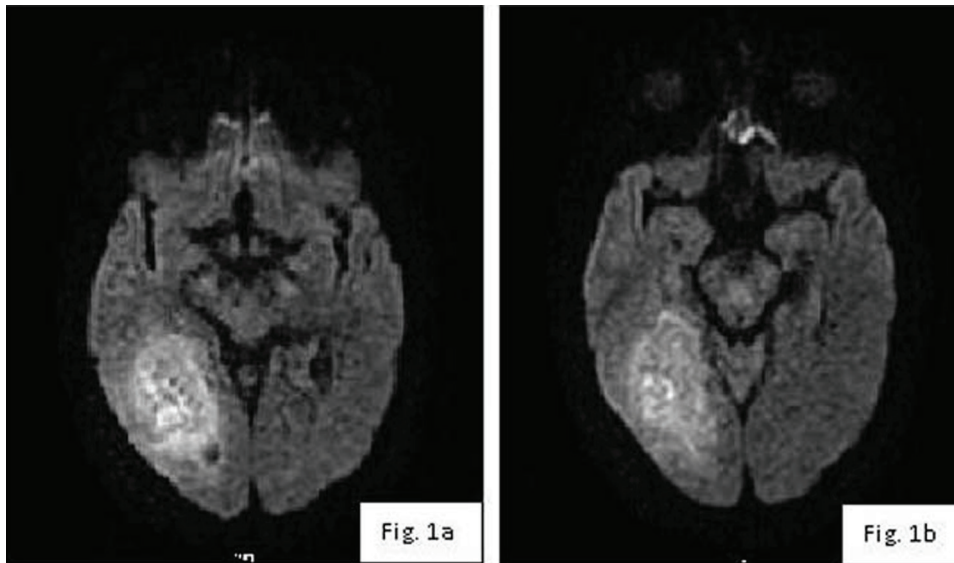


Figure 1 MRI of the brain prebiopsy.

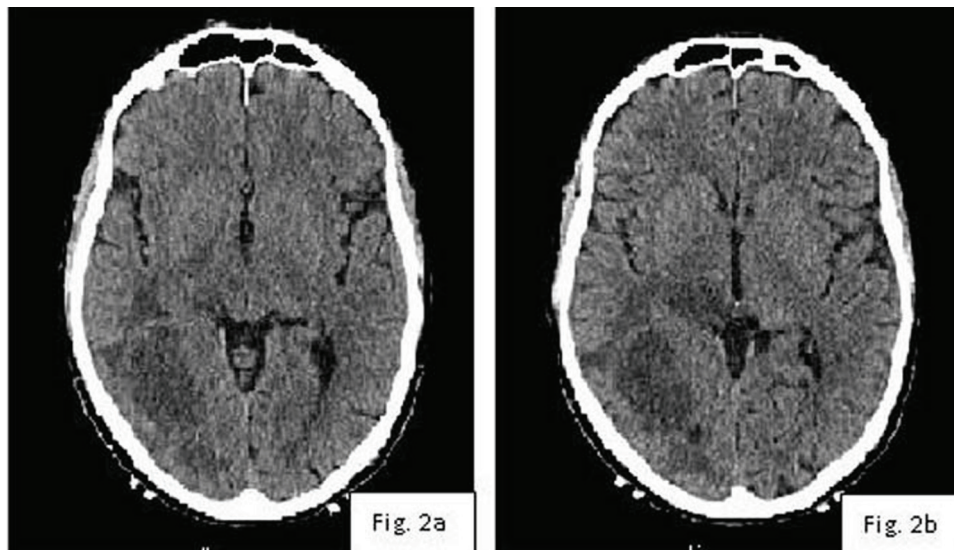


Figure 2 CT of the head postbiopsy.

controlled by oral medications for the past 10 years. He also had ulcerative colitis for which he had undergone a colectomy in the past. His current medications at the time included oral hypoglycaemics for his diabetes and loperamide for his bowel condition. He was a non-smoker and had no known drug allergies.

Examination

On examination, his general physical, cardiovascular and respiratory examinations were all normal and he was vitally stable. On confrontation visual field testing, he had a left upper quadrantanopia and an increased blind spot in his left eye. On being shown a bright object, he had normal after-images and no palinoptic images were formed. When examined later when he was experiencing palinopsia, the image of his attendant’s blue jumper was visible to him in his left visual field. The palinoptic image did not

change in size with relation to the background and moved in an opposite direction to passive movement and in the same direction as active movement of his eyes. This was in line with what has been reported by Bender *et al.*² The image eventually disappeared on its own after about 10 min. Funduscopy did not reveal any papilloedema. Also, the patient had no parietal lobe signs on bedside neurological examination. The rest of his neurological examination was normal.

INVESTIGATIONS

In keeping with his history and symptoms, an MRI of his brain was ordered (figure 1A,B). It showed a right hemispheric ring enhancing tumour involving the parietal, occipital and temporal lobes. Marked oedema was present but there was no midline shift. The imaging criteria were highly suggestive of a primary glioblastoma.

A biopsy was performed, which showed a Glioblastoma Multiforme WHO Grade IV. His tumour was subsequently debulked and a CT scan was ordered before his operation for surgical planning. The CT scan (figures 2A,B) showed a 5.5 × 2.8 cm peripherally enhancing mass lesion centred on the right parietal lobe, which extended from the ependymal surface of the right lateral ventricle to the subcortical white matter. There was low attenuation and swelling in the ipsilateral thalamus. The adjacent convexity sulci were effaced but there was no midline shift. His blood tests for erythrocyte sedimentation rate, C reactive protein, full blood count, fasting blood sugar, urea and electrolytes, liver and thyroid function tests were all within normal limits. Formal visual field testing was performed in this patient privately, both before and after his operation. Unfortunately, the records of these were unavailable. The patient's notes during his hospital stay, however, referred to the visual field perimetry results and confirmed that they were in keeping with the bedside testing mentioned earlier and that the defect remained unchanged postoperatively.

TREATMENT

After successfully undergoing debulking of his tumour, the patient had an uneventful recovery and was sent home.

OUTCOME AND FOLLOW-UP

His visual field defect persisted postoperatively but he did not complain of any further episodes of palinopsia. He was shifted to the care of the oncology team for palliative care after being discharged from our neurology service.

DISCUSSION

Palinopsia is a rare phenomenon and its mechanism is disputed. There may be a number of mechanisms for palinopsia in general, and more than one factor may be involved in any single patient. Much of the difficulty in unravelling the causes of palinopsia lies in its rare and transient occurrence.¹²

Patients with palinopsia usually have visual field disturbances, and these are more commonly left sided, reflecting the importance of posteriorly placed, right-sided cerebral lesions.² According to Bender *et al*, palinopsia occurs in visual fields that are defective but not blind. Apart from visual field defects, a number of other clinical features may be associated.^{1-2 13} Illusions of movement may occur, as may visual perseveration in space (illusory visual spread) such that, for example, the pattern of a wallpaper appears to spread to adjacent structures. There were no such associations in our patient, but he did have a left-sided visual field defect.

Bender *et al*² proposed four possible mechanisms of palinopsia: visual after-sensations, sensory seizures, hallucinations and psychogenic elaborations or fantasies. Although different entities, these authors noted similarities between normal after-images and palinoptic images and considered many occurrences of palinopsia to be visual after-sensations generated at the cerebral level.¹⁰

Cummings *et al*¹¹ considered palinopsia to be a type of release hallucination resulting from loss or suppression of normal visual input, and emphasised the need to

distinguish it from ictal palinopsia caused by seizures. Palinopsia caused by seizures has several characteristic features, including accompanying signs of seizure activity, absence of hemianopia and spread of palinoptic images to involve the whole visual field.^{7 11 14} Various articles have reported cases of patients with seizures presenting with palinopsia^{7 14} but there was nothing to suggest such causality in our patient in either his history or symptoms.

Palinopsia has often been associated with organic brain disease, for example, trauma,^{15 16} parasite,¹⁷ abscess,^{18 19} stroke,^{20 21} tumour^{2 20} Creutzfeldt–Jakob disease,²² multiple sclerosis,²³ carbon monoxide poisoning,²⁴ non-ketotic hyperglycaemia¹² and migraine,²⁵ schizophrenia,^{26 27} psychotic depression²⁸ and Charles Bonnet syndrome²⁹ and arteriovenous malformations.^{30 31} As already reported, our patient had a brain tumour but no evidence of the other aforementioned lesions. We also came across a report of palinopsia following a subcortical haemorrhage¹⁰ and therefore showed his scans to a neuroradiologist who cleared his scan of any such lesion. The interesting point about our patient was the fact that he had no more episodes of palinopsia following the debulking of his tumour. We could not find a similar case after thoroughly reviewing the relevant literature.

Several drugs that have been associated with palinopsia share a 5-HT₂-receptor activity, including lysergic acid diethylamide,³² trazodone,³³ nefazodone,³⁴ risperidone³⁵ and more recently, mirtazapine.³⁶ Topiramate has also been suggested to have serotonergic activity and a case report has been published documenting it as a cause of palinopsia.³⁷ Marijuana,^{4 5} mescaline,¹ 3,4-methylenedioxymethamphetamine (ecstasy),³⁸ interleukin-2³⁹ and clomiphene citrate⁴⁰ have also been reported to be causes of palinopsia. None of the reported drugs were being taken by our patient so they seem an unlikely contributory factor in him.

Recording visual evoked potentials (VEP) in this patient would have been extremely interesting and helpful to our understanding of the elusive phenomenon that is palinopsia. Unfortunately though, the patient is deceased and during his admission, the test was not possible. Furthermore, after conducting an extensive review of the literature, we could find no mention of VEP either done in patients with palinopsia or even suggested as a possible useful test and feel this is something to be addressed in future research on the topic.

Interestingly, Bayesian inference has been suggested as a possible mechanism that the brain uses to predict its visuospatial surroundings.⁴¹⁻⁴³ When the Bayesian theorem is applied to vision, the probability of one's surroundings being a particular way when one cannot see them can be predicted. This can be done with given information (here, the sensory information the brain receives), which is directly proportional to two quantities that can, in principle, be estimated in advance. In the context of the brain, these quantities can be stored in one's memory and be recalled when predicting one's visuospatial surroundings.⁴³ Thus, Bayesian theory says that we can predict images in our surroundings using stored memories of previous images. Scientists have long hypothesised that we use this predictive inference of our surroundings when we look around. As in our patient, a defect in this mechanism

Learning points

- ▶ Palinopsia is a distortion of processing in the visual system in which images persist or recur after the visual stimulus has been removed.
- ▶ It is a dysfunction of the association areas at the junction of temporal, occipital and parietal lobes, and can be triggered by any lesion or dysfunction in this region.
- ▶ In our case, it disappeared once the tumour in this region was surgically debulked, thus supporting posterior association cortex dysfunction as its cause.
- ▶ VEP should be considered in future palinoptic patients.
- ▶ Bayesian inference is a possible cause of palinopsia.

could produce persistence of images after the exciting stimulus has gone, as the brain would now be wrongfully predicting that its subsequent surroundings are related to their previous images. Further work is required in this field and we hope our article can open the gateway for such future research.

Competing interests None.

Patient consent Obtained.

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