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Case Report

Posterior cortical atrophy: a case report on a rare form of dementia

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Abstract

First described about three decades ago by D. Frank Benson and occasionally referred to as Benson's disease, posterior cortical atrophy (PCA) is a rare, debilitating, progressive neurodegenerative condition characterized mainly by declining visuoperceptual/spatial capabilities, and structurally by occipito-temporal/parietal lobe atrophy. Although research evidence suggests a 5% incidence of PCA amongst people diagnosed with Alzheimer's disease, standard epidemiological data for PCA remains relatively scarce, possibly due to a lack of clinical awareness of the condition and an under-recognition plus under-reporting of its variable phenotypic presentation. There also appears to be difficulties in consistency with the classification, as well as a lack of proper validation of congruous diagnostic criteria with regards to PCA. This case report describes the clinical presentation of a 55-year-old Caucasian female diagnosed with PCA and the management strategy. The report also highlights the role of multimodal imaging and neuropsychology in arriving at a potential diagnosis.

Key words

Multimodal Imaging, Neurodegenerative Disorder, Neuropsychological Testing, Posterior Cortical Atrophy

Introduction

With the increasing trend in life expectancy, it is no longer uncommon knowledge that neurodegenerative conditions are on the increase. The rarer sub-classes of dementias are now being seen more often in clinical practice, more disturbingly, in the younger age groups.[1] With this trend, traditional and conventional methods of investigating and detecting such conditions appear to be waning, as clinical specialists look to more sensitive tools for detection and differentiation of pathology, especially in its early phases. In vivo neuro-imaging, particularly of multimodal (structural and functional) capacity has become especially important to pinpoint regional vulnerability in the early stages of neurodegenerative disorders and for monitoring future therapeutic strategies.[2] Neuropsychological testing also appears to be key in establishing a formal diagnosis, and in distinguishing early aetio-pathological variations pertaining to rarer forms of dementias.[3]

Posterior cortical atrophy (PCA) can be described as a neurodegenerative condition characterised by substantial, progressive, and a relatively particular reduction in visual processing skills and other functions sub served by parietal, occipital and occipito-temporal regions[4]. The phenotypic variability in presentation, relative rarity of PCA, and the relatively young age at onset does bring about a misdiagnosis in several patients.[4] Though in most part, the underlying aetiopathology of PCA are attributable to Alzheimer's disease, diagnostic inconsistences do exist due to aetiologic heterogeneity (Lewy body dementia, cortico-basal degeneration, prion disease). Even where recognised as a clinico-radiological syndrome[5], not all sufferers present with volume loss or atrophy on imaging. Furthermore, when radiologically compared to typical Alzheimer's disease presentations, biological mechanisms responsible for regional or differential vulnerability in brain images are currently unknown. Notably, longitudinal studies have shown sparing of hippocampal, frontal and entorhinal regions in PCA.[5]

The use of multimodal imaging techniques, applied in clinical settings, could play a major role in accurately identifying and differentiating atypical forms of Alzheimer's (i.e. PCA) most importantly, in the early phases, as seen in this case report of diagnosed PCA in a 55 year old Caucasian female.

Case history

A 55-year-old Caucasian female presented with an 18-month history of cognitive impairment and worsening vision. She complained of short-term memory deficits, reduced coordination and poor visuospatial awareness. She was also experiencing myoclonic jerks daily.

There were also associated functional impairments. She was requiring increasing input from her husband for activities such as cooking, managing finances and use of electronic devices within the home. Her driving was also affected. In one instance, she hit a pillar after drifting close to the curb. There was no evidence of affective or psychotic symptoms.

Assessments

Clinical assessment and investigations

Her past medical history included fibromyalgia and Sjogren's syndrome. There was no prior history of psychiatric illness, vascular risk factors or traumatic brain injury. Routine blood tests were unremarkable. There was no evidence of visual field defects or retinal pathology on examination.

Neuroimaging

Following worsening vision, an MRI scan of the head was requested. The scan showed normal sized ventricles and no evidence of lesions. There were also no abnormalities of the optic nerve identified.

She was then subsequently reviewed by neurology a couple of months later and a fluorodeoxyglucose positron emission tomography (FDG PET)/CT scan of her brain was requested. The scan showed moderate reduced grey matter differentiation in the parietal lobes bilaterally, more prominent on the right and mildly reduced activity in the right and left lateral temporal lobes, again more prominent on the right. There was mildly reduced activity within the left and right lateral occipital lobes. There was also reduced activity within the left and right precuneus region which was more severe on the right. There was maintenance of activity in the frontal and medial occipital lobes.

Addenbrooke's Cognitive Examination III score was completed and she scored 69/100, which was below the cut off score of 82. There were deficits across all domains of memory, verbal fluency, language, attention and visuospatial abilities. Difficulties were particularly prominent in the visuospatial domain.

Neuropsychological assessment

Based on the patients educational and employment history, an estimate of her premorbid functioning placed her in the 'high average' range of ability on the Wechsler Adult Intelligence Scale.

On the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), her performance in the visuospatial/constructional index was impaired, falling within the 'extremely low' range. Her performance in the immediate and delayed memory domain was also impaired, again falling within the 'extremely low' range. Her performance on the language domain of the RBANS was comparatively less impaired in the 'low average' range but still below her estimated level of pre-morbid functioning. The Sydney Language Battery (SYDBAT) was also administered. She was able to identify and name 27/30 items indicating relative sparing of language functioning on the tests administered. On the Visual Object and Space Perception Battery (VOSP), there was a deficit in performance on each of the space perception tests with scores falling below each test's respective cut-off score. Her reading was slow in speed and her writing was reported to be illegible.

Overall testing revealed a global deficit in cognitive functioning and deficits in visuospatial skills with a particular deficit in spatial perception. There were deficits in episodic memory and attention with relative sparing of language ability.

Given the findings she was referred to the cognitive disorder clinic at University College London Hospital where a diagnosis of Posterior Cortical Atrophy (PCA) was confirmed after a further evaluation of the patient's history, neurological examination, cognitive assessments and a repeat of some of the prior neuropsychometric testing. This revealed marked visual perceptual and spatial dysfunction, severe calculation difficulties, memory impairment and limb apraxia. A lumbar puncture was offered to investigate the underlying aetiology; however, the patient did not wish to have this.

Management

Research evidence suggests that some patients experience improvement in their symptoms and a slowing of progression with an acetylcholinesterase inhibitor, as the aetiology in the vast majority of PCA is Alzheimer's disease.[4] Donepezil 5mg daily was commenced, increased to 10mg daily after a month. Patient did not experience any side effects and daily functioning improved slightly within this period. She also received an extensive information pack providing further information on the illness and symptoms. She was further referred to the Alzheimer's Society.

Patient was reviewed after 3 months. At the review she scored 20/30 on the Mini Addenbrooke's Cognitive Examination which showed an improvement of 5 points compared to when she was last reviewed. On the Bristol Activity of Daily Living Scale (BADLS), she scored 9/60, which indicated an improvement in functioning, though with prompts and also some support provided with activities of daily living. She was happy to continue taking donepezil. She continues to be socially active and has further reported improvement in mobility generally.

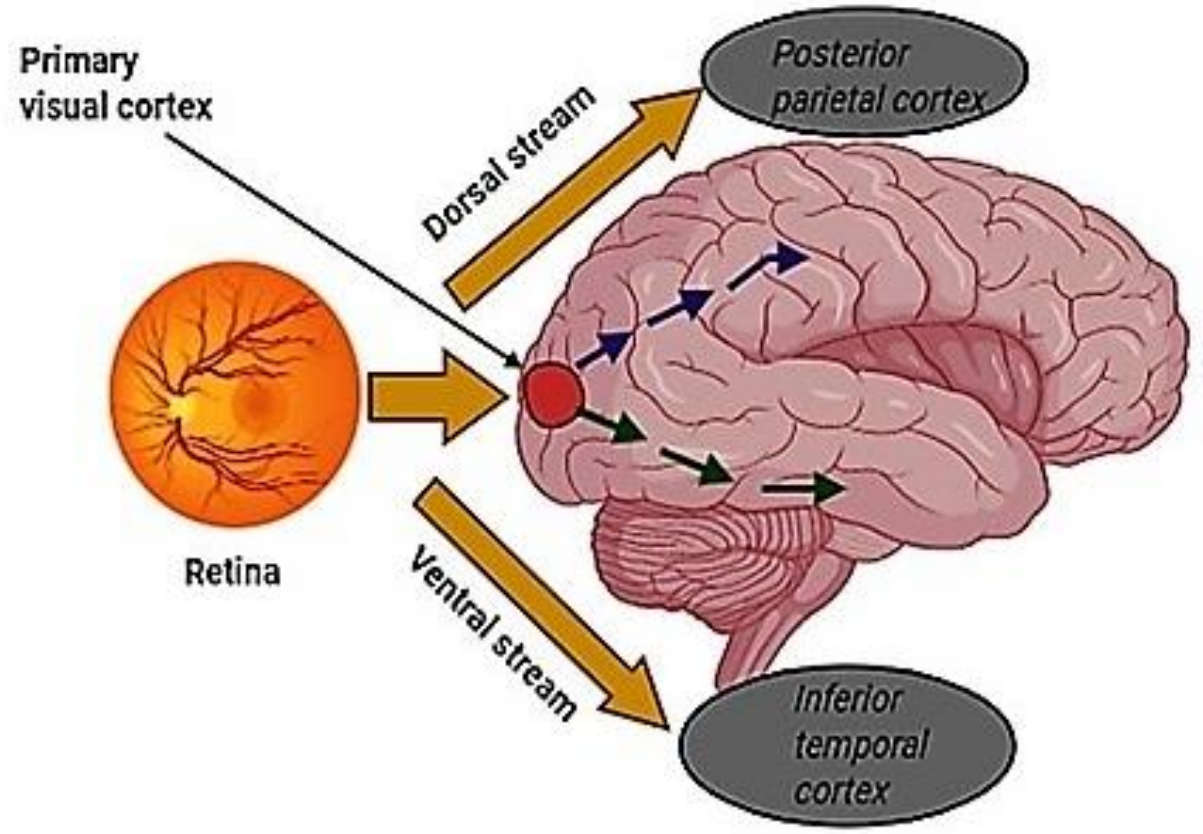
Discussion

Pathophysiology of PCA

In 1988, at the University of California, San Francisco (UCSF), American neurologist, Dr Frank Benson evaluated five patients, and described them as presenting with a progressive disorder of higher order visual function, while also noting that other cognitive abilities such as insight, judgement and memory had remained intact. Further imaging analysis depicted atrophy in the posterior aspect of the brain which were vital for visual processing. Speculating that the condition was an atypical form of Alzheimer's due to the manner of progression, Benson would name the condition, 'posterior cortical atrophy'.[6]

To fully appreciate the pathophysiology behind PCA, a relative understanding of the normal visual processing within the brain is required as illustrated in Fig 1 below.

Fig 1: Processing of visual stimulus in the brain



Visual stimulus, via a variety of networks is transmitted into the occipital cortex, to a specific area of the brain known as the primary visual cortex. This is the site where visual information is primarily processed. By a series of higher order visual processing and utilizing two main brain pathways or circuits as seen in Fig 1, the brain is able to interpret the stimulus from the retina. The dorsal visual stream relays visual information from the occipital cortex to the parietal cortex which mainly determines spatial relationships. The ventral visual stream relays information to the temporal cortex which helps to identify exactly what is being seen, objects or faces for instance.

In a diffusion tensor magnetic resonance imaging tractography study looking at the dorsal and ventral visual pathways of seven patients with a confirmed diagnosis of PCA, bilateral fasciculus abnormalities were detected and damages to pathways which mirrored clinical phenotypic presentations in the patients were also identified.[7]

Our patient presented mostly with dorsal cognitive deficits, possibly indicative of damage to the fronto-parietal superior longitudinal fasciculus.

Genetic risk factors for PCA

The direct aetiology of PCA, just like Alzheimer's disease is largely considered to be unknown and it is also not very well established as to whether the risk factors for both Alzheimer's disease and PCA are identical. Links to specific genetic mutations are speculative and have also been broadly unknown.

Prior single laboratory studies contemplated the effect of APOE (common genetic risk factor for late onset Alzheimer's disease) as a potential genetic risk factor in PCA pathology and nominated CLU, BIN1 and ABCA7 as likely loci of risk in both PCA and Alzheimer's disease.[8]

More recently, in 2016, genome wide association studies involving a consortium of 11 centres, across Europe, the United states and Australia, involving 302 participants provided insight into 3 possible novel candidate loci implicated as strong risk factors for PCA: loci near CNTNAP5, FAM46A and SEMA3C.[9] For PCA, the study also indicated a less strong or less likely association with the APOE4 allele.

Difference of PCA from early onset Alzheimer's disease (EOAD)

The pathological entities comprising Alzheimer's disease and PCA are closely and almost usually identical. However, key differences underlie their cognitive features. Differences in Neuropsychological features which distinguish PCA from EOAD include impairments in visuospatial, visuoperceptual, visuoconstructive and

handwriting functions which are usually more impacted upon, compared to EOAD.[10] This was shown in part by the patient's neuropsychometric test results, which were notably within the 'extremely low range' in some of these functions. Memory is usually also well preserved in the initial phases of PCA when compared to EOAD.

Management of PCA

According to the Alzheimer's society, there are no specific medications for the treatment of PCA.[11] The acetylcholinesterase inhibitors utilized in mild to moderate Alzheimer's disease have been found to be helpful in some patients especially those with known Alzheimer's disease aetiology from the start.

Treatment with low dose methylphenidate specifically to improve motivation and engagement in activities of daily living have been found to be beneficial in a particular report.[12]

Single case reports have identified more complementary and alternative forms of medicine such as chiropractic spinal manipulation and dynamic neuromuscular stabilization in the improvement in patients' perception of health and the overall satisfactory progress in the quality of life. The report stressed the essentials of adjunctive rehabilitative treatment to more conservative pharmacological treatment especially in patients with additional motor disturbances.[13]

Support groups run by the rare dementia support UK organise national and regional support groups where individuals affected share experiences and hear the latest in research and information. They also encourage engagement in pleasurable activities for affected individuals as well as provide support with activities of daily living.[14]

Role of multimodal imaging and neuropsychology

In summary, with the increasing prevalence of the rarer forms of neurodegenerative conditions, traditional MRI sequences are usually not able to specifically identify and differentiate regional pathology and, when used in isolation, are not sufficiently sensitive to detect and quantitate neurodegenerative or neuroinflammatory processes. Multimodal imaging techniques, which combines imaging modalities, can identify these conditions by characterizing micro alterations and quantifying metabolic changes, quite relevantly, and at early stages, which may precede soft tissue pathology. In some aspects, such techniques can also define internal microanatomy, identify grey matter changes and could also be sensitive to microstructural alterations resulting from neuroinflammatory and neurodegenerative processes.[2,15] This was seen in the case history which initially showed normal MRI features, but depicted neurodegenerative pathology on PET-CT. The importance of neuropsychological testing in reaching the relevant diagnosis is also worth mentioning. Testing has revealed deficits mostly attributable to deteriorating visuospatial skills, as well as impaired spatial perception and general sparing of language abilities. Neuropsychological tests that evaluate the dorsal visual stream are particularly sensitive to PCA.[16]

Conclusion

This case report contributes to the literature base of one of the rare forms of dementia (PCA) and may improve further awareness of the condition. Application of multimodal imaging and neuropsychologial assessments at the clinical level may prevent misdiagnosis and may assist the patient in receiving appropriate supportive measures early.

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References

1. Nwaubani P, Nazir E. Primary progressive aphasia: a case report on diagnostic issues: J Geriatr Care Res 2018; 5(1):6-8.

2. Crombe A, Planche V, Raffard G, Bourel J, Dubordieu N, Panatier A, Fukutomi H, Dousset V, Oliet S, Hiba B, Tourdias T. Deciphering the microstructure of hippocampal subfields with in vivo DTI and NODDI: Applications to experimental multiple sclerosis. Neuroimage 2018; 172: 357–368.

3. Aresi A, Giovagnoli AR. The Role of Neuropsychology in Distinguishing the Posterior Cortical Atrophy Syndrome and Alzheimer's Disease. J Alzheimer's Dis 2009; 18(1):65-70.

4. Crutch SJ, Lehmann M, Schott JM, Rabinovici GD, Rossor MN, Fox NC. Posterior cortical atrophy. Lancet Neurol 2012; 11:170–8.

5. Firth NC, Primativo S, Marinescu RV, et al. Longitudinal neuroanatomical and cognitive progression of posterior cortical atrophy. Brain 2019; 142(7):2082-95.

6. Benson DF, Davis RJ, Snyder BD. Posterior cortical atrophy. Arch Neurol. 1988; 45(7):789-93. doi: 10.1001/archneur.1988.00520310107024.

7. Migliaccio R, Agosta F, Scola E, et al. Ventral and dorsal visual streams in posterior cortical atrophy: a DT MRI study. Neurobiol Aging. 2012;33(11):2572-84. doi: 10.1016/j.neurobiolaging.2011.12.025.

8. Carrasquillo MM, Khan Qu, Murray ME, et al. Late-onset Alzheimer disease genetic variants in posterior cortical atrophy and posterior AD. Neurology. 2014;82(16):1455-62. doi: 10.1212/WNL.0000000000000335.

9. Schott JM, Crutch SJ, Carrasquillo MM, et al. Genetic risk factors for the posterior cortical atrophy variant of Alzheimer's disease. Alzheimers Dement. 2016 Aug;12(8):862-71. doi: 10.1016/j.jalz.2016.01.010.

10. Li J, Wu L, Tang Y. et al. Differentiation of neuropsychological features between posterior cortical atrophy and early onset Alzheimer's disease. BMC Neurol. 2018;18, 65. https://doi.org/10.1186/s12883-018-1068-6

11. Alzheimer's Society UK. [Internet] Posterior Cortical Atrophy. United Kingdom, 2020. [Cited 2020 November 12] Available at https://www.alzheimers.org.uk/about-dementia/types-dementia/Posterior-cortical-atrophy

12. Mendez MF. Methylphenidate Treatment for Patients With Posterior Cortical Atrophy. J Neuropsychiatry Clin Neurosci. 2018 Fall;30(4):334-336. doi: 10.1176/appi.neuropsych.17120356.

13. Francio VT, Boesch R, Tunning M. Treatment of a patient with posterior cortical atrophy (PCA) with chiropractic manipulation and Dynamic Neuromuscular Stabilization (DNS): A case report. J Can Chiropr Assoc. 2015;59(1):37-45.

14. Rare Dementia Support. [Internet] Posterior Cortical Atrophy. United Kingdom, 2020. [Cited 2020 November 12] Available at https://www.raredementiasupport.org/posterior-cortical-atrophy/

15. Treit S, Steve T, Gross DW, Beaulieu C. High resolution in-vivo diffusion imaging of the human hippocampus. Neuroimage. 2018; 182:479-487. doi: 10.1016/j.neuroimage.2018.01.034.

16. Crutch SJ, Schott JM, Rabinovici GD, Boeve BF, Cappa SF, Dickerson BC, Dubois B, Graff-Radford NR, Krolak-Salmon P, Lehmann M, Mendez MF, Pijnenburg Y, Ryan NS, Scheltens P, Shakespeare T, Tang-Wai DF, van der Flier WM, Bain L, Carrillo MC, Fox NC. Shining a light on posterior cortical atrophy. Alzheimers Dement. 2013 Jul;9(4):463-5. doi: 10.1016/j.jalz.2012.11.004.