ORIGINAL SCIENTIFIC ARTICLES

Clinico-radiologic Profile of a Dorsal Variant of Posterior Cortical Atrophy in a 55- year old Female

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ABSTRACT

Posterior Cortical Atrophy is a group of neurodegenerative disorders characterized by early, prominent and progressive impairment of visuospatial and visuoperceptual functions in the context of relatively preserved memory and insight in the early phases. Initial visual symptoms are vague, compelling patients to seek ophthalmologic consult. They present with simultagnosia and spatial disorientation, which are often missed by routine ophthalmologic and neurologic exams, causing delay in diagnosis. As the disease progresses, Posterior Cortical Atrophy ultimately leads to a more diffuse pattern of cognitive dysfunction. The underlying pathology is believed to be Alzheimer's Disease and a greater level of amyloid plaques is correlated with earlier clinical symptoms of Posterior Cortical Atrophy. The clinical features of reported cases are heterogenous, leading to a classification of different variants and underlying pathologies. We report the serial clinical, cognitive and imaging data of a variant of Posterior Cortical Atrophy primarily affecting the dorsal stream.

Keywords: Posterior Cortical Atrophy, Alzheimer's Disease, simultagnosia, ApoE polymorphism, amyloid, Dorsal variant, FDG-PET, Neuropsychological testing

INTRODUCTION

Posterior Cortical Atrophy (PCA) is a progressive dementia with a young onset (late 50s and early 60s[1]) presenting with visuospatial and visuoperceptual challenges. Alzheimer's Disease is the most common underlying disease pathology and as the disease progresses, PCA ultimately leads to a more diffuse pattern of cognitive dysfunction. The clinical features of reported cases are heterogenous, leading to a classification of different variants and underlying pathologies.

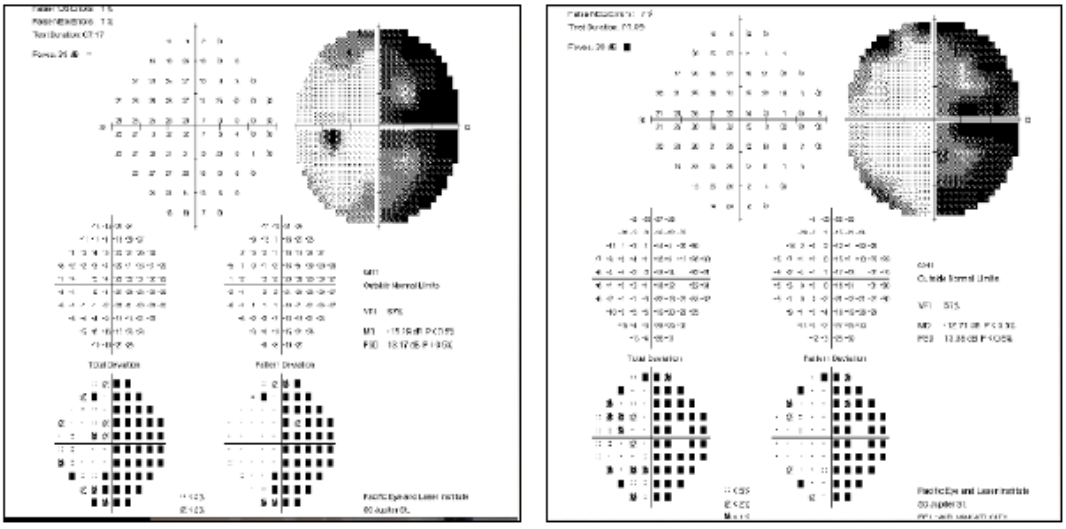
CASE REPORT

A 55-year old right-handed woman, previously healthy, was referred from Ophthalmology service for evaluation of visual changes and progressive symptoms of cognitive decline over the past four years. She had fourteen years of formal education and a degree in Management and previously taught Chinese language. There was no history of head trauma, infection, psychiatric disease, or illicit drug use and no family history of neurodegenerative diseases.

She initially reported difficulty reading and writing. She wrote sentences with missing words and could not write in one line. Most striking was her inability to locate things that were directly in front of her. Ophthalmology consult revealed right homonymous hemianopsia on perimetry (Fig 1). She described the Boston cookie theft picture in a piece-meal fashion. Focusing on multiple objects on a screen presented challenges. However, she was able to name objects when presented individually.

Clock drawing test was unsatisfactory with missing numbers (Fig. 2). Over the next two years, she had difficulty with simple arithmetic. She wore clothes inside out, wore a shoe on one foot and a slipper on the other. She was lost in places previously familiar to her and would follow unfamiliar individuals in a crowd. She confused items, rooms and faces, eventually needing assistance in choosing clothes for dressing, meal preparation, using the telephone, traveling, handling finances and taking medications. Examination showed a patient who was disoriented to time, place and person.

Fig 1. Formal perimetry testing showed right homonymous hemianopsia



Neuropsychological evaluation revealed moderate to severe cognitive impairment in all explored domains (Table 1). All visual tasks were severely impaired, particularly attempts to integrate a complex visual picture into a meaningful whole. Full lateral and vertical gaze were possible when she carefully followed a moving object but jerky saccades were noted when initiating gaze. She had difficulty reaching for a stationary object held in front of her. A strong tendency to fix gaze on a single object was noted. She interpreted Ishihara color vision testing plates as "candies". New learning was limited. She was only able to draw a circle and write her name. Follow-up tests of constructional praxis showed progressive impairment in spatial orientation (Figs 2 & 3). Word-finding difficulty was evident. She had impaired calculation, right-left disorientation, agraphesthesia, astereognosis, and finger agnosia.

Laboratory tests were negative for thyroid disease, metabolic disorders, and inflammatory or auto-immune diseases. Cranial MRI showed hippo-campal volume of 6.83 (0.51% of the intracranial volume), which is within 63 normative percentile.

Predominant parieto-occipital atrophy, more evident in the left hemisphere was also noted (Fig 4). FDG-PET showed marked posterior hypo-metabolism bilaterally (Fig 5). Genetic testing showed ApoE e3/e3 on genotyping by PCR. Multimer Detection System test for AD ratio was normal.

DISCUSSION

Posterior Cortical Atrophy presents with predominantly visual symptoms, with simultangnosia as the most frequent (above 90%)[3] deficit in PCA. Problems with describing the Boston cookie theft picture and inability to read pseudoisochromatic plates are highly conspicuous for simultagnosia[1]. In simultagnosia, there is inability to synthesize the overall meaning of the visual scene despite being able to recognize single elements. A controversial visual finding is a homonymous visual field deficit in the absence of a corresponding structural lesion on brain imaging. This is due to higher order visuospatial deficits that may compromise interpretation of the visual field tests and occurrence may precede a higher order visual disorder[4,5].

Neuropsychological testing of patients with PCA reveals poorer performance IQ compared with

Table 1. Comparison of Psychometric Score results done in 2017 and 2018.

Test	July 7, 2017		October 2, 2018		Remarks
	Score	Classification	Score	Classification	
ADAS-COG	43	Severe Impairment	No Data	No Data	No Data
Montreal Cognitive Assessment Philippines (MoCA-P) (30)	2	Severe Cognitive Impairment	2	Severe Cognitive Impairment	No Change
Verbal fluency (Total # Animals)	3	Moderate Impairment	5	Moderate Impairment	No Change
Boston Naming Test (15)	3	Moderate Impairment	3	Moderate Impairment	No Change
Word List Memory Task (30)	6	Moderate Impairment	No Data	No Data	No Data
Constructional Praxis (11)	2	Moderate Impairment	0	Moderate Impairment	No Change
Word List Recall (10)	1	Moderate Impairment	1	Moderate Impairment	No Change
Word List Recognition	7.5	Moderate Impairment	4	Moderate Impairment	No Change
Recall of Constructional Praxis (14)	0	Moderate Impairment	0	Moderate Impairment	No Change
Logical Memory (10)	0	Mild Impairment	0	Mild Impairment	No Change
Trailmaking Test A (180 seconds)	Unsuccessfully Accomplished	Baseline	Unsuccessfully Accomplished	Baseline	No Change
Trailmaking Test B (300 seconds)	Unsuccessfully Accomplished	Baseline	Unsuccessfully Accomplished	Baseline	No Change
Digit Symbol (#correct)	Unsuccessfully Accomplished	Baseline	Unsuccessfully Accomplished	Baseline	No Change
Geriatric Depression Scale for Dementia	Unsuccessfully Accomplished	Baseline	Unsuccessfully Accomplished	Baseline	No Change

Fig 2. Clock drawing test in 2014 (left), 2017 (middle), and 2018 (right) highlight progressive deficits in constructional ability.

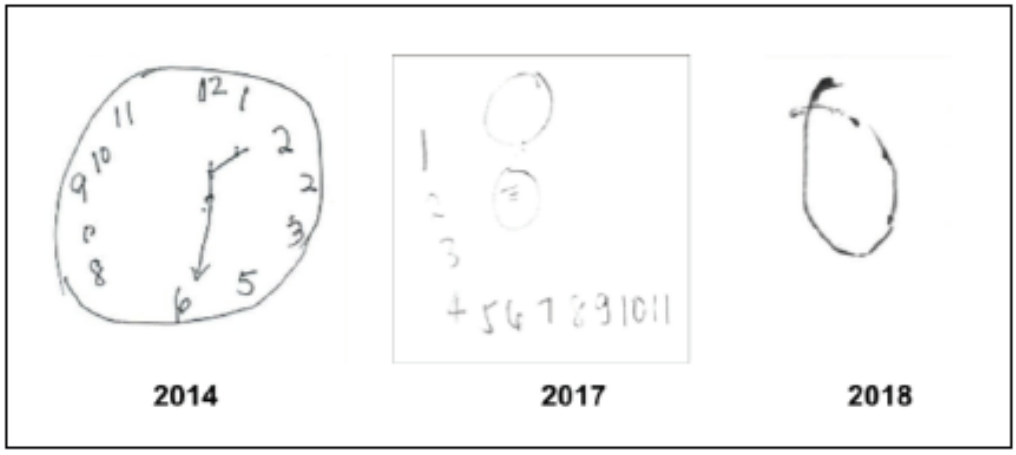


Fig 3. Copying figures (2017 vs 2018) test showed line distortion and lack of elements due to visual deficits.

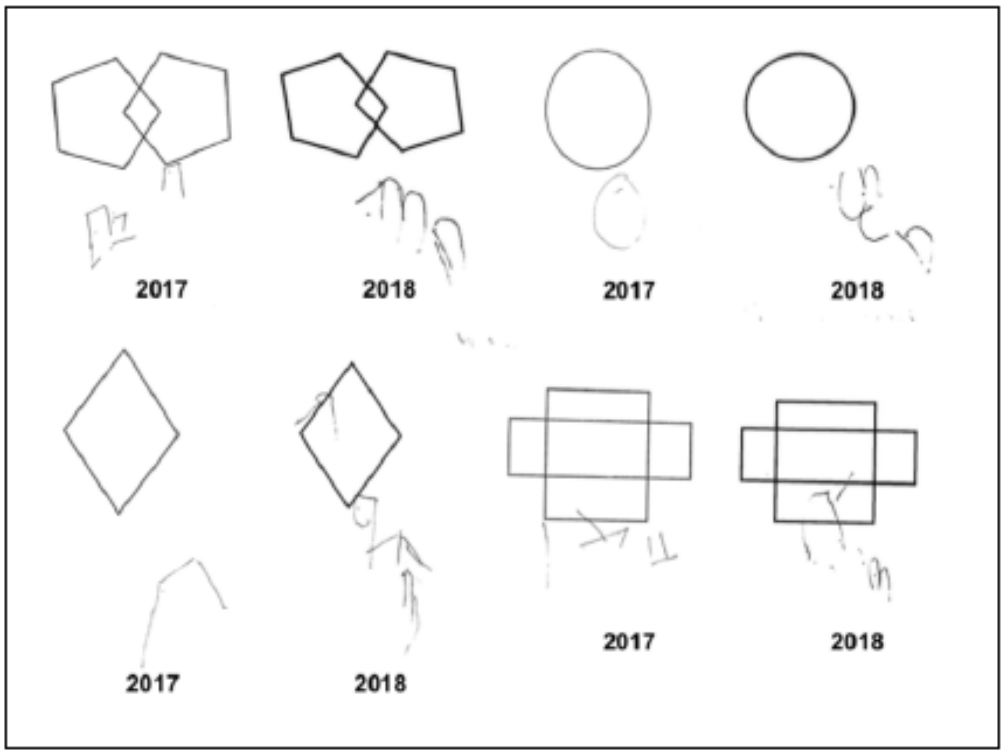


Fig. 4. Comparison of Cranial Magnetic Resonance Imaging (2014 and 2017) T1-weighted sequence, axial (2014, A; 2017, B) and sagittal (2014, C; 2017, D) views. Cerebral volume loss is present, predominantly in the parietal and occipital lobes (blue arrow), seen in the widening of the posterior cingulate and parieto-occipital sulci bilaterally (red arrow), more evident in the left hemisphere.

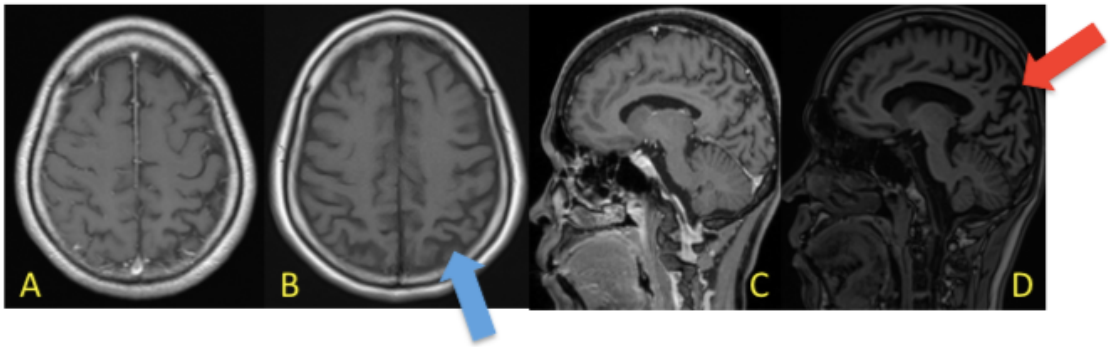
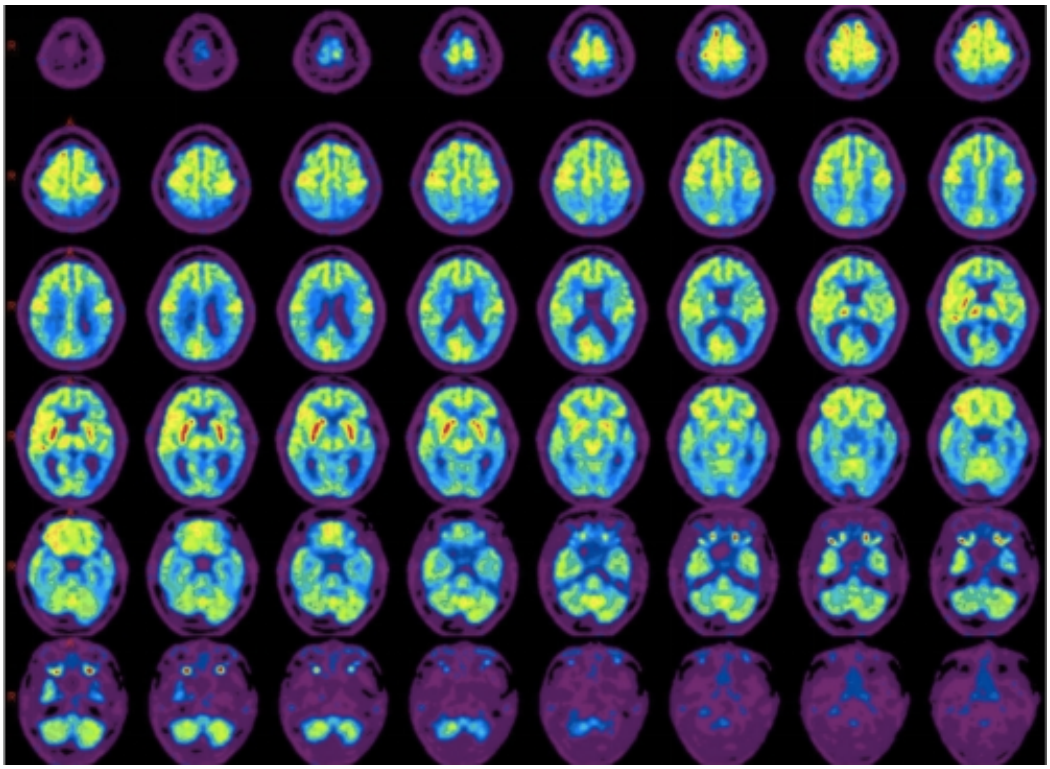


Fig 5. Fluoro-deoxyglucose PET images. Generalized decreased FDG uptake in the biparietal, bitemporal and bioccipital lobes with mild decreased uptake in the bifrontal lobes.



verbal IQ[1]. Perceptual organization and processing speed presented as a bigger challenge compared to verbal comprehension and working memory (Table 2) due to visual disorientation (failure to track), ocular apraxia (failure to generate saccades), reverse-size phenomenon (difficulty reading large texts) and optic ataxia (inability to reach for objects under visual guidance)1. Naming and defining function of objects without cues was manageable but tasks involving visual perception such as picture completion, block design and Rey-Osterrieth complex figure tests were unsuccessfully completed.

Serial imaging studies showed widening of the posterior cingulate and parieto-occipital sulci and marked hypometabolism in the occipitoparietal regions, particularly the bilateral parietal lobes

Table 2. Verbal IQ vs Performance IQ (2018)

SUBTEST	Raw Score	Scaled Score	Qualitative Description
Verbal Comprehension Subtests			
Similarities	4	1	Extremely Low
Vocabulary	15	4	Borderline
Information	2	2	Extremely Low
Perceptual Reasoning Subtests			
Block Design	0	1	Extremely Low
Matrix Reasoning	0	1	Extremely Low
Visual Puzzles	0	1	Extremely Low
Working Memory Subtests			
Digit Span	3	1	Extremely Low
Arithmetic	0	1	Extremely Low
Processing Speed Subtests			
Symbol Search	0	1	Extremely Low
Coding	0	1	Extremely Low

Table 3. Semiquantitative evaluation of the percentages of Fluoro-deoxyglucose uptake when compared to the basal ganglia. Measurements showed generalized decrease update most prominent in the bi-parietal lobes.

	Right	Left
Frontal	75-100	60-100
Parietal	40	40
Temporal	40-75	40
Occipital	40-70	40-70
Caudate nuclei	100	90
Putamen	100	100
Thalamus	100	75
Cerebellum	60	60

(Table 3). This is consistent with the Biparietal/ Dorsal variant of Posterior Cortical Atrophy[3] with features of the Balint's syndrome in contrast to the Occipitotempral/Ventral variant in which impaired visuoperceptive functions are more prominent. Simultanagnosia was associated with hypometabolism in the right occipital lobe, posterior cingulum and visual cortex. Optic ataxia was associated with involvement of the left occipital and visual cortex, while oculomotor apraxia with left parietal lobe and posterior cingulum[6]. These areas of hypometabolism explain deficits consistent with posterior parietal and occipital pathologies. The underlying pathology of PCA is believed to be Alzheimer's Disease with the ApoE e4 poly-morphism[7]. However, genotyping in this patient revealed ApoE e3/e3 alleles. Previous literature studies support the hypothesis that a greater load of amyloid plaques is correlated with earlier clinical symptoms of PCA, especially in the posterior lobes. However, the patient's Multimer Detection System test for AD ratio was normal. This case may provide new insight into the role of ApoE e3 allele and amyloid levels in the etiology of Posterior Cortical Atrophy.

SUMMARY

The dorsal variant of posterior cortical atrophy presents with simultagnosia and compromised visuospatial function, reflected in poorer performance IQ compared to verbal IQ. Cranial MRI and PET scans show bilateral parieto-occipital atrophy and hypometabolism. Although greater amyloid burden is expected for a patient with early clinical symptoms, this case demonstrates otherwise. Due to the presenile onset of disease and variability of clinical features as the initial presentation, recognition of these symptoms is crucial to avoid misdiagnosis.

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