Posterior cortical atrophy: an overview for optometrists

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Introduction

Posterior cortical atrophy (PCA) is a neurodegenerative syndrome that is characterised by a progressive decline in visuospatial and visuospatial skills[1,2]. Precise estimates of the prevalence and incidence of PCA are difficult to determine; this largely owes to an under-recognition of the PCA syndrome, misdiagnosis, and certain inconsistencies in the application of clinical and research criteria for PCA. Estimates to date have been based on specialist dementia and memory clinics, which include reports of between 8-13% of patients as having predominant visual disturbances in addition to nonvisual symptoms characteristically associated with PCA, such as difficulties with writing, calculation, spelling, handwriting and praxis skills[3,4]. All of this leads easily to misinterpretation of routine ophthalmological investigations using automated static perimetry, crowded Snellen letter or Ishihara colour charts.

Causes and symptoms

The most common cause of PCA is Alzheimer's disease (AD), although PCA may also arise from other forms of dementia such as dementia with Lewy bodies, corticobasal degeneration and prion disease[1,2]. Diagnosing PCA requires ruling out other causes of central visual loss, the most common of which is stroke. Beyond significant vascular disease including focal stroke, PCA exclusion criteria include afferent visual cause, brain tumour or other mass lesion, and other non neurodegenerative causes of cognitive impairment[1]. For people who have PCA caused by AD, differences have been noted in the distribution of pathology (amyloid plaques and neurofibrillary tau tangles) compared to people who have more typical, memory-led AD[5–7]. These differences have been observed particularly within parts of the occipital lobe that are relatively unaffected in typical AD.

Brain imaging studies have identified reductions in grey matter volume in posterior parietal, occipital and posterior temporal cortical regions in PCA, in contrast to relatively sparing of medial temporal lobe structures, which are characteristically affected in typical AD[8,9].

Consistent with how PCA affects areas towards the back of the brain, patients' symptoms include a range of complex disturbances in visual function (http://links.lww.com/CONT/A266). Some of the earliest symptoms frequently relate to problems with driving (for example, clipping car wing mirrors or having difficulty parking), reading, and missing objects presented in clear view[10,11]. Some symptoms are very counter-intuitive, including particular difficulties perceiving large relative to small text, cursive font or handwriting, having difficulty recognizing objects that are presented from unconventional, but not conventional angles, or positioned in peripheral vision, or objects that are close together being perceived as merging or combining into one object[12,13]. Such symptoms may become particularly apparent during complex tasks, for example in completing a puzzle. People may experience problems reading clocks; for some people, such problems may be particularly apparent with digital clocks or signs. Some people may become lost in familiar environments, have difficulty judging depth when walking or reaching for objects, or have problems in understanding terms such as 'left' and 'right'. People may exhibit particular problems when negotiating stairs, particularly with uneven steps, escalators and shiny or patterned flooring. Other difficulties may include objects that should be stationary appearing to move or slide around, possibly relating to impaired saccadic eye movements or visual fixation[14–16].

Acquired dyslexia is a common and debilitating consequence of PCA, in contrast to more typical AD, where reading tends to be preserved until intermediate disease stages. In PCA, acquired dyslexia tends to manifest as becoming lost on a page of text[1]>, with letters or words sometimes appearing to move around; particular difficulties perceiving large relative to small text (e.g. headlines of newspapers but not smaller font), cursive font or handwriting; and letters that are close together appearing to merge or jumble up[12,13].

Symptoms that lack an explicit visual component include problems with dressing, for example, having difficulty using buttons, clasps or zips, locating the sleeves of a jacket while dressing, or putting clothes on back to front. Finding a piece of cloth from a large pile can be just as difficult as finding on a busy dining table a particular dish which varies of course with eating culture. People may experience loss of calculation and spelling abilities, changes in handwriting, or difficulties carrying out skilled and complex actions. While memory and language functions tend to be relatively well preserved in people with PCA at least at earlier stages of the disease, people may experience memory and word-finding problems, albeit to a lesser extent than those seen in typical AD[9].

Diagnosis

People with PCA often experience a very drawn out diagnostic process. In most cases, the patient will have had multiple appointments with optometrists and ophthalmologists before suspicion of a neurological condition is raised. Patients may occasionally be told they have a psychiatric condition, menopause, or be misdiagnosed with having had a stroke[10,11]. Patients may spend a large amount of money on pairs of glasses or undergo

surgery before discovering that their visual symptoms have a cortical basis. Typically they do very badly with varifocals.

People with PCA tend to experience a combination of visual processing and eye movement abnormalities[14], in addition to problems with spatial awareness and to a lesser extent, memory. Patients may experience excessive visual crowding, problems locating objects in space and difficulties perceiving large versus small objects. Documented eye movement abnormalities in PCA include reduced saccadic amplitude and difficulty maintaining stable gaze position[14,1]>. Implications of such problems include inappropriateness of conventional presentation of standard acuity charts for people with PCA, who may have more difficulty with (larger) items at the top of a chart, struggle with items presented with less spacing owing to excessive crowding, and having difficulty maintaining fixation or moving from one item to the next.

Diagnosing PCA requires detailed neurological and neuropsychological assessment, which may be greatly aided through one or more MRI scans. PCA can be distinguished from cortical visual loss due to stroke owing to the insidious and progressive nature of symptoms and lack of an acute episode. PCA tends to have a young onset presentation, although patients may be affected as young as in their 40s or as old as in their 90s[1]>. Patients may undergo cerebrospinal fluid (CSF) and blood tests, particularly to exclude reversible causes of dementia but also to provide evidence for underlying AD pathology or other rarer neurodegenerative diseases (e.g. prion disease).

What to look for in practice

Certain procedures can be used in optometric practice to assess PCA features. These include:

- Visual acuity (VA) and examination of the eye, which tend to be normal in PCA if appropriately assessed. Adaptations to acuity measures are recommended to reduced susceptibility to object localization problems, fixating instability and excessive crowding: presenting items one at a time can mitigate these issues (see below: 'Recommendations from neuro-ophthalmologists').
- Ishihara chart results are poor, but not because of dyschromatopsia but because of the broken pattern with scattered dots.
- Dissociation between static and dynamic perimetry, also known as the Riddoch phenomenon[2]>
- Cortical Vision Screening Test (CORVIST)/ Visual Object and Space Perception Battery (VOSP)/Queen Square Screening test (see Resources)
    - Fragmented letters (see Figure for example stimulus)
    - Dot counting
    - Number location
    - Shape discrimination
    - Shape detection

Particular challenges have been noted with tests such as the Amsler Grid and visual field analysis, in addition to tests with more subjective components such as colour vision, depth perception and visual acuity[2]>.

Recommendations from neuro-ophthalmologists include:

- Noting tendency to miss letters on an acuity chart, especially more crowded letters based on location (in the middle) or visual similarity (e.g. E v T).
- Noting visual symptoms with an emphasis on becoming lost in familiar and unfamiliar environments
- Noting unexplained difficulty with Ishihara plates (which may be susceptible to difficulties perceiving fragmented objects/objects among visual clutter)
- Being aware of inconsistent apparent homonymous field defects
- Adapting acuity measures to reduce susceptibility to object localization, fixation instability and excessive crowding, e.g. by presenting items one at a time[2]>.

Other practical considerations include involving patient care partners during the testing process, taking breaks, allowing more time for assessment to accommodate more complex needs. For a summary of recommendations, see[2]>.

Treatment and support

There is a role for an integrated care pathway (ICP). Individuals will benefit from a neuro-psychological assessment for diagnosis and monitoring of disease progression. A cognitive neurology service has access to dedicated MRI and CSF biomarker investigations, as well as having access to pharmacological treatment options. A neuro-ophthalmologist has access to low visual aid services which included counselling and registration as sight impaired with Certificate of Vision Impairment.
Referral to a neurologist with an interest in dementia is recommended. Pharmacological interventions may offer symptomatic treatment for AD, including acetylcholinesterase inhibitors (AChEIs) and an NMDA receptor antagonist (memantine); however, as with AD there are currently no treatments proven to alter the progression or outcome of PCA. AChEIs have been noted to provide some clinical benefit in people living with PCA[2]>.

Low visual aids (LVA) may be helpful for reading. Training in the use of a telescopic white stick may be extremely helpful[11]; some individuals find it a relief to have this option in stressful environments such as a busy train platform during London rush hour, and of course have the option to fold and picket the telescopic stick if not needed. Cognitive rehabilitation techniques have only been attempted in a small number of patients, and reported benefits are modest. There is some evidence that PCA patients may benefit from strategies such as improving symptom understanding, visual scanning training and training to use tactile rather than visual information[24,2]>. However, the progressive nature of the condition, as well as the concurrent visual, spatial and later memory disturbances experienced by people with PCA pose significant challenges to appropriate rehabilitation or support. Neuropsychological investigations have provided evidence of benefits of reducing visual clutter, object placement (increasing spacing, presented centrally versus peripherally) and maximising contrast on object recognition in PCA[13]. There is some evidence of reading aids[17,26] and environmental adaptations in managing functional disability in PCA (contrast or lighting adaptations[27,28]).

Many patients and caregivers have reported benefits of mixed peer-to-peer and professional support groups (http://www.raredementiasupport.org/pca/), particularly for emotional and practical support, sharing strategies, tips and advice, and accessing relevant services. Appropriate healthcare professionals may include psychologists, occupational therapists and sensory teams, particularly those with experience of working with people with rare and young onset forms of dementia. Patients and caregivers often report benefits of physical home adaptations[2]> (see https://www.raredementiasupport.org/posterior-cortical-atrophy/living-with-pca/ ; https://www.youtube.com/channel/UCuVA3iffOcwz04qBkjZgKqg). Being registered as partially sighted or severely sight impaired has been recommended despite normal single letter, high contrast visual acuity[11,22]. Other recommendations include asking patient to inform the DVLA of their PCA diagnosis.

Resources

CORVIST: https://www.corvist.org/ -
VOSP:
https://www.pearsonclinical.co.uk/Psychology/AdultCognitionNeuropsychologyandLanguage/AdultPerceptionandVisuomotorAbilities/VisualObjectandSpacePerceptionBattery(VOSP)/VisualObjectandSpacePerceptionBattery(VOSP).aspx
Queen Square visual screening test booklet - https://onlinestore.ucl.ac.uk/product-catalogue/faculty-of-brain-sciences-c07/ucl-institute-of-neurology-d07/d07-the-queen-square-screening-test-for-visual-deficits)
PCA testing toolkit[30]

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Multiple choice question examples

What is the most common cause of posterior cortical atrophy?
A) Alzheimer's disease
B) Creutzfeld Jakob disease
C) Corticobasal degeneration
D) Small vessel disease
E) TDP-43

Which one of the following is a characteristic early symptom of PCA?
A) Difficulty articulating words
B) Behavioural disinhibition
C) REM sleep behaviour disorder
D) Problems with driving
E) Tremor

What percentage of people seen in specialist dementia clinics present with predominant visual or motor disturbances?
A) 70-74%
B) 47-53%
C) 21-39%
D) 8-13%
E) 2-4%

Which of the following regions of the brain are most affected in PCA?
A) Frontal
B) Medial Temporal
C) Limbic system
D) Parieto-occipital
E) Cerebellum

Which one of the following is NOT a symptom commonly associated with PCA?
A) Difficulty dressing
B) Problems recognising objects presented from unconventional angles
C) Difficulties understanding the meaning of words
D) Difficulties negotiating stairs
E) Disturbances in controlling eye movements

Which of the following is something NOT reported by neuro-ophthalmologists in relation to people with PCA?
A) Inconsistent apparent homonymous field defects
B) Monocular visual loss

C) Unexplained difficulty with Ishihara plates

D) A tendency to miss letters on an acuity chart

E) Visual symptoms are noted with an emphasis on becoming lost in familiar and unfamiliar environments

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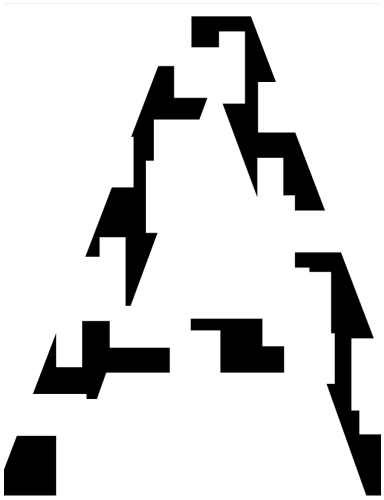

Figure: Example fragmented letter