Brain Perfusion SPECT in Dementia

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Case 1

- 81 yo woman with progressive cognitive decline
- MMSE 24/30
- MRI
- SPECT
CASE 1

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FUSION

PC
Case 1

- Findings: Bilateral temporoparietal association cortex hypoperfusion, posterior cingulate hypoperfusion
Case 1 Question

- Posterior cingulate hypoperfusion is a feature of:
  A. Alzheimer’s Disease
  B. Frontotemporal Dementia
  C. Jacob-Creutzfeldt Disease
  D. Vascular Dementia
Case 1 Answer

• A. Correct. The finding is earliest of AD. It is not a finding specific to FTD, JCD or VD.

• B. Incorrect because this finding is rarely found in FTD

• C. Incorrect because in the pattern of JC Disease does not feature posterior cingulate hypoperfusion as specific

• D. Incorrect because vascular dementia usually appears as strokes which may not involve posterior cingulate

Case 1 Teaching Points

- Alzheimer’s Disease is manifested by decreased uptake in bilateral temporo-parietal association cortices and in posterior cingulate on SPECT
- Patients with AD often have concomitant microvascular disease which is seen on MRI
CASE 2

- 83 yo man with progressive cognitive decline, mainly memory
- MMSE 27/30
- MRI
- SPECT
CASE 2
CASE 2

• Findings: Left frontal subdural collection with compressive effects in left frontal cortex. Severe hypoperfusion in left frontal cortex and moderate hypoperfusion of left basal ganglia. Cerebellar diaschisis.
Case 2 Question

• Anatomic Imaging with CT or MRI in dementia is not sensitive for:
  A. Subdural hematoma
  B. Brain tumors
  C. Normal pressure hydrocephalus
  D. Neurodegeneration
Case 2 Answer

- D. Correct. Anatomic imaging is more sensitive than SPECT in subdural fluid collections, mass lesions and ventriculomegaly associated with NPH. On the other hand, functional imaging has more sensitivity for neurodegenerative disease.

- A. Incorrect because CT or MRI are sensitive for subdural hematoma
- B. Incorrect because CT or MRI are sensitive for brain tumors
- C. Incorrect because CT or MRI are sensitive for ventriculomegaly out of proportion to degree of atrophy seen in NPH

Case 2 Teaching Points

- Anatomic Imaging is important in dementia evaluation and often should be done before functional imaging to exclude mass lesions or other anatomic abnormalities that could help explain symptoms.
- Prior history of craniotomy or head injury should be known.
Case 3

• 73 yo with cognitive impairment and atherosclerosis
CASE 3
Case 3

• Findings: Right much greater than left sensorimotor preservation, visual cortex preservation. Moderately decreased perfusion throughout left hemisphere and left basal ganglia. Association cortex hypoperfusion.
Case 3 Question

- Vascular dementia and Alzheimer’s Disease share commonalities except:
  A. Co-occur in estimated 30%
  B. Can have symptomatic response to donepezil
  C. Cause visual cortex defects
  D. May have insulin resistance as a risk factor
Case 3 Answer

- C. Correct. Visual defects are not common in AD (primary cortices tend to be preserved). “Mixed” dementia is common and both AD and VD can symptomatically respond to donepezil. Insulin resistance appears as a risk factor for both.
- A. Incorrect because AD and vascular disease do commonly co-occur in 30%
- B. Incorrect because both AD and VaD can symptomatically respond to donepezil
- D. Incorrect because insulin resistance seems to be a risk factor for both (Craft)
Case 3 Teaching Points

• Mixed dementia is common (estimated 30%).
• Effect of vascular disease on course of neurodegeneration is likely deleterious.
Case 4

- 85 yo with dementia and prominent visual hallucinations
Case 4

Findings: Visual cortical hypoperfusion and bilateral parieto-temporal hypoperfusion
Case 4 Question

- The pathologic substrate in Lewy Body Dementia is associated with:
  A. Beta-amyloid
  B. Tau protein
  C. Alpha-Synuclein
  D. Prion
Case 4 Answer

- **C. Correct.** Alpha-synuclein is common in Parkinson’s and DLBD. Amyloid is more associated with AD, Tau with FTD and prion with JCD.
- **A. Incorrect** because beta-amyloid is more associated with AD than DLBD
- **B. Incorrect** because tau protein is most associated with FTD not DLBD
- **D. Incorrect** because prions are associated with JC dementia and other rare dementias

**References:**
Case 4 Teaching Points

- Diffuse Lewy Body Dementia is estimated second most common neurodegenerative disease causing dementia (after AD)
- Patients can have a fatal response to neuroleptic drugs like Haldol
- Parkinsonian symptoms, visual hallucinations (visual cortex deficit on SPECT) and fluctuating cognition are often present
Case 5

- 63 yo with complaints of cognitive decline with personality change and behavioral disturbance
- MMSE 30/30
Case 5
Case 5

Findings: Hypoperfusion of frontal and anterior temporal lobes.
Case 5 Question

- What neurologic disorder has a common association with frontotemporal dementia?
  A. Motor Neuron Disease
  B. Myasthenia
  C. Epilepsy
  D. Multiple systems atrophy
Case 5 Answer

• A. Correct This is a known association with ALS type syndromes. Myasthenia, epilepsy and MSA are not commonly associated with FTD.
• B. Incorrect because myasthenia is not commonly associated with FTD.
• C. Incorrect because epilepsy is not commonly associated with FTD.
• D. Incorrect because MSA is not commonly associated with FTD.

Case 5 Teaching Points

• Frontotemporal Dementia can be familial as was the case with this patient
• Behavioral disturbances often precede and supercede cognitive deficiency
• Concern when reading scan must be taken into account for issues of major unipolar depression and prior history of head injury, alcoholism
Case 6

- Progressive cognitive decline in a 73 yo patient with diabetes mellitus and hypertension
- MMSE 20/30
CASE 6
Case 6

- Findings: Focal severe defect in left parietal cortex. More moderate hypoperfusion in left PCA and MCA territory.
Case 6

• Question 6: The patient’s most likely diagnosis is:
  A. Epilepsy
  B. Alzheimer’s Disease
  C. Depression
  D. Left parietal-occipital stroke
Case 6 Answer

- D. Correct. This is a parieto-occipital stroke. Epilepsy and depression are not associated with cognitive decline with a focal parietal defect. AD can be asymmetric but is usually bilateral.
- A. Incorrect because epilepsy does not have a specific predilection for parieto-occipital region
- B. Incorrect because AD does not usually present as a single parieto-occipital defect, although its presentation can be asymmetric, it is usually bilateral
- C. Incorrect because depression is not usually associated with parieto-occipital defects. Depression can be in the differential of frontal and paralimbic defects.
Case 6 Teaching Points

- Vascular Disease can be a source of cognitive impairment and parietal strokes can sometimes mimic AD
- This patient needs further evaluation for vascular disease and may need evaluation of left hemispheric perfusion reserve
Summary: Brain SPECT in Dementia

• AD most common and manifested by posterior cingulate deficit as earliest manifestation with later bilateral temporoparietal association cortex hypoperfusion. Preservation of sensorimotor perfusion is often very helpful diagnostic sign.

• DLBD next most common neurodegenerative cause, visual cortex uptake is often less than thalamic uptake.
Summary: Brain SPECT in Dementia

• Vascular disease can co-exist with AD or be primarily responsible for cognitive impairment

• Anatomic imaging is critical for evaluation, usually in advance of functional imaging, but is essential to have available when interpreting SPECT as findings such as strokes, microvascular disease, etc, will inform SPECT reading. Fusion is very helpful.

• FTD less common but important differential consideration which must also be corroborated against past medical history

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