

CT

Useful for:

- Scores below ACE-III cut off for possible dementia
- Clinical history highly suggestive of a neuro- degenerative condition.
- Clinical history suggestive of other organic cause
- Positive response to any of the screening questions for normal pressure hydrocephalus, frontotemporal dementia or cerebrovascular disease.
- Onset of visual hallucinations within first 6 months of cognitive impairment / confusion.
- Meets MRI protocol but patient has contraindications for MRI – see MRI section below
- History of cancer that could metastasise to the brain.

CT is a well-established, widely available and quick to perform (1-2 minutes) tool which the vast majority of patients tolerate well. CT is relatively inexpensive (significantly cheaper than MRI), however is associated with radiation exposure, which can therefore limit the use of serial scanning.

A volumetric CT should be performed as it can be reconstructed into a coronal plane and has been shown to be as good as MRI for quantifying medial temporal lobe volume and detecting atrophy (which occurs in Alzheimer's disease). The sensitivity and specificity of using CT alone in detecting medial temporal lobe atrophy is 94% and 93% respectively.

It should be noted that there are risks of false interpretation when using a CT scan with regard to Vascular Dementia, as older people will often have vascular changes which in or of themselves are not pathognomonic of vascular dementia. MRI is more useful if Vascular Dementia is suspected.

Scan reports are very dependent on the information provided by the requesting clinician. For CT scans, in addition to details about the patient and their history/symptom progression, it is important that the clinician seek specific clarification on the presence of medial temporal lobe (hippocampal) atrophy, significant vascular ischaemic change and the presence of other intracranial pathology such as tumours. Consideration should be given to requesting coronal sections on local PACS, such that these are readily available for review without the need for third party software for reconstructions. See resource 'Scan Requests' for suggested wording of scan requests.

MRI

Useful for:

- People with history of cognitive impairment aged less than 65 years old
- People with history of cognitive impairment but who have scores above cognitive assessment (e.g. ACE-III) cut off
- People with clinical history highly suggestive of a neuro-degenerative condition
- Atypical presentation
- Acute or rapidly progressive dementia

In practice, although MRI is becoming more widely used in the investigation of dementia, it can be poorly tolerated by some (typically older) patients and those with late stage dementia. MRI studies take 25 minutes to perform and the patient has to lie perfectly still in a tunnel with their head restricted within a helmet (the MRI coil). The scan produces an extremely loud noise which can be frightening and disorientating for the patient.

However, MRI scans do have a place in the assessment of people with dementia. MRI is better at identifying subtle vascular changes and detecting changes that may indicate specific (rarer) conditions such as multiple sclerosis, progressive supranuclear palsy, cortico-basilar degeneration, prion diseases and limbic encephalitis. Also MRI may be better at detecting atrophy in the posterior parietal regions in patients suspected of having younger onset Alzheimer's disease.

MRI imaging consideration should be given to having a dementia specific protocol, which should at least include a volumetric sequence (preferably coronal) to ensure adequate morphological assessment of key brain structures as well as enabling the fusion of morphological and functional imaging data sets to provide more detail.

Your radiology department may have a stance on undertaking MRI's in this patient group.

3.2 Functional Scanning

Techniques available include positron emission tomography (PET) with fluoro-deoxyglucose (FDG) and amyloid plaque tracers and single photon emission computed tomography (SPECT) with perfusion tracers e.g. HMPAO. PET imaging is recognised as having increased accuracy (94% accuracy in differentiating patients with normal cognition from Alzheimer's Disease) over SPECT imaging in dementia and should be considered if available locally. Functional imaging of dopaminergic neurones with DAT scan can assist in the diagnosis of dementia with Lewy bodies (DLB)⁴.

Best practice suggests an MDT approach when selecting a specialist scan. Where there is uncertainty around the diagnosis when interpreting the results an MDT approach should also be taken.

3.2.1 DAT Scan

Useful for:

- Assessment in those with suspected Lewy Body dementia (i.e. presenting with a history of visual hallucinations commencing within first 6 months of symptoms and positive score of 2 or more on the Lewy Body screening questions (see resource 'Screening Questions for Assessment Proforma').
- Differentiating between Alzheimer's and Lewy Body dementia
- Differentiating between Parkinson's Disease and Lewy Body dementia

Hypersensitivity reactions have been reported following DAT scan administration. The reactions have generally consisted of skin erythema and pruritis and have either resolved spontaneously or following the administration of corticosteroids and anti-histamines. Other adverse reactions are reported to occur at a rate of 1% or less with the reported events consisting of headache, nausea, vertigo, dry mouth or dizziness. These reactions were of mild to moderate severity.

3.2.2 FDG PET-CT Scan

Useful for:

- Differentiating between Alzheimer's disease, vascular dementia and Frontotemporal dementia if the diagnosis is in doubt
- Detecting Alzheimer's disease where diagnosis is complex (e.g. young onset)

The FDG PET Scan takes approximately 2 hours to complete and the machine is fairly quiet and less claustrophobic than an MRI.

The patient should have been fully assessed by an expert clinician and a conventional image PREVIOUSLY undertaken.

Note: *if a patient is diabetic this test becomes more difficult to interpret*

3.2.3 SPECT

Useful for:

- Differentiation between Alzheimer's disease, vascular dementia and frontotemporal dementia

- Where diagnosis is unclear or difficult to establish via CT or MRI scans e.g. MCI or co-morbid mental illness in potential young onset dementia
- Where there is complex presentation which may be related to underlying mental health problems but where the clinician suspects that the underlying cause maybe dementia.

SPECT findings in Alzheimer's disease centre on the detection of hypoperfusion of the temporal and parietal brain regions. Comparing clinical diagnosis, SPECT findings and post-mortem examination, SPECT was found to increase the diagnostic certainty in patients who were clinically diagnosed with Alzheimer's disease from 84 to 92%. The same study found that a negative SPECT in these patients reduced the diagnostic certainty to 70%.

3.2.4 Amyloid PET

The Amyloid PET scan is an area of increasing promise, however is not in regular clinical use. This scan is not currently in the NHS England contract and is being considered on a case by case basis.