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The Role of the Neurologic Examination in the Diagnosis and Categorization of Dementia

John R. Wherrett, MD, FRCP(C), PhD, Professor Emeritus, Division of Neurology, University of Toronto; consultant in Neurology, Toronto Western Hospital and Toronto Rehabilitation Institute; member, Memory Clinic, Toronto Western Hospital, Toronto, ON.

Nonneurologist practitioners faced with the diagnosis of dementia cannot be expected to conduct the detailed assessments for which neurologists are trained. Nonetheless, they should be able to diagnose the most common forms of neurodegenerative dementia and identify individuals that require more detailed neurologic workup. A neurologic examination algorithm is described that allows the practitioner, in a stepwise and efficient manner, to elicit findings that distinguish the main categories of neurodegenerative and vascular dementia, namely, Alzheimer's disease, dementia with Lewy bodies, vascular dementia, and frontotemporal lobar degenerations. Patients are assessed for gait, frontal signs, signs of parkinsonism, signs of focal or lateralized lesions, neuro-ophthalmologic signs, and signs characteristic of frontotemporal lobar degeneration.

Key words: *neurologic, examination, neurodegenerative, dementia, diagnosis, gait, frontal dysfunction, cognitive impairment*

Introduction

Neurological skill resides in the ability to elicit symptoms and assess the validity of signs that confirm neurodegenerative and cerebrovascular symptoms, and the capacity to adapt the examination to physiologic dysfunction and anatomical lesions at a point in time. From this data, along with evidence about evolution and progression, hypotheses as to the pathology are postulated for confirmation or refutation by subsequent clinical and laboratory testing.

Assessment of the mental state, and to some degree behaviour, is an essential component of the neurologic examination. However, this article addresses the rest of the neurologic exam—the so-called noncognitive neurologic examination.

Neurologists are trained to perform a formal examination which, through experience with numerous disorders of the nervous system, becomes both focused and selectively elaborated to best characterize the disorder under consideration. Other practitioners involved in the care of the neurodegenerative dementias will not have had this experience or the time for this approach yet should be able to make the diagnosis in many, if not most, patients and to decide if referral for formal neurologic assessment is required.

A Focused Algorithm for Neurological Examination in Dementia

This reviewer recommends that nonneurologists engaged in the assessment of a patient with presumptive dementia adopt an examination algorithm directed at delineating the more common forms of dementia. The neurologist will proceed with the premise of a much longer list of diagnostic possibilities. The algorithm should allow the nonneurologist to develop skills and experience that will facilitate rapid diagnosis. For a review of the comprehensive neurologic examination in aging and dementia please refer to the series in *Geriatrics & Aging* published by Gladstone and Black in 2002.[1]

A classification of the common neurodegenerative dementias is kept in mind

Table 1: Neurologic Signs in the Common Dementias

	Alzheimer's disease	Dementia with Lewy bodies	Vascular dementia	Frontotemporal lobar dementia
Gait disorder	Late	Early	Early	Early or Late
Signs of frontal dysfunction	Late	Late	Early	Early
Parkinsonism	Late	Early	Early or Late	Early or Late
Neuro-ophthalmologic signs	May have early visuo-perceptual disorder	No	No	Early or Late (gaze palsy)
Focal or lateralizing signs	May have early aphasia	No	Early	No
Signs of frontotemporal lobar degeneration	No	No	No	Early (aphasia, apraxia, motor neurone signs)

throughout the examination (Table 1). Note that these pathologies are often mixed so that distinctions may be obscured and clinical experience and judgment come into play. As well, systemic and geriatric disorders will complicate the findings. The following are then assessed in order: gait; signs of frontal dysfunction; signs of parkinsonism; neuroophthalmologic signs; signs of focal or lateralized lesions; and additional signs of frontotemporal lobar degenerations.

Gait

Observe gait as the patient enters the office. In the mild and moderate stages of dementia abnormal gait unexplained by lower-level disorders (such as arthritis, polyneuropathy, radiculopathy, myopathy, myelopathy) signifies disorders other than Alzheimer's disease, most commonly parkinsonism and vascular disease.

Parkinsonian Gait

The parkinsonian gait is classified as a middle-level disturbance[2] since it reflects a brainstem/diencephalic disorder. It is characterized by flexed stooped posture, the base remains narrow, stride is shortened, and foot clearance is reduced (giving the shuffling quality) and disequilibrium. A greater tendency to flexed posture, a reduction in arm swing, and festination (propulsion or retropulsion) are more suggestive of parkinsonism than so-called frontal or frontal-subcortical gait disorders. This may be difficult to distinguish from the frontal gait disorder appearing in dementing disorders.

Frontal Gait Disorder

Frontal gait disorder is seen most commonly with vascular dementia and late in the course of Alzheimer's disease (AD). It is classified as a highest-level disorder.[2] Frontal gait disorder is characterized by variable broadening of base, short shuffling steps, start and turn hesitation, moderate disequilibrium, preserved arm swing, and upright posture. These individuals appear to be cross-country skiing on cement. Persons with mild or unrecognized dementia have also been described as having vascular parkinsonism or lower body parkinsonism.

Signs of Frontal Dysfunction

Signs of frontal dysfunction are always included in discussions of the signs of dementia, but are rarely assessed, even described as soft because of uncertain sensitivity and specificity, and dependency on the context of the examination. Nevertheless, as persistent behaviours and responses they help to refine diagnosis.

Paratonia

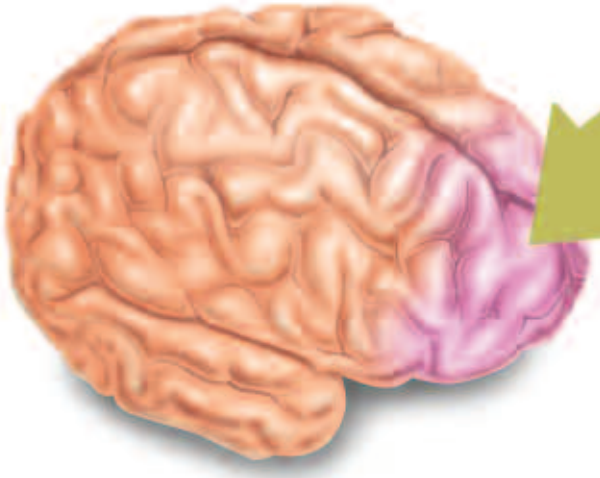
The motor disorder that appears earliest in the course of dementia is paratonia,[3] also called gegenhalten (Figure 1).[4] This phenomenon occurs with lesions of the mesial frontal lobes. The frontal lobes encompass almost half the cortical mantle, and their functions are not assessed by conventional screening tests such as the Mini Mental Status Examination. When examining tone in an individual with paratonia, there seems to be inability to relax the limbs, with an inclination to resist, or paradoxically to assist, passive movements in a persistent reflex fashion. The resistance seems to adjust to the force applied and to increase the more rapidly the limb is displaced. It affects the whole limb as opposed to particular muscle groups, such as flexors or extensors, and is exerted in any movement or posture.[5]

The conventional method for eliciting paratonia involves manipulating the limbs during standard testing of muscle tone. Almost always associated with the finding of paratonia is the tonic grasp phenomenon originally characterized by Denny-Brown and also shown to strictly reflect mesial frontal lesions.[6] This is conveniently elicited when the hands are held in a crossed, shaking hands manoeuvre, and the examiner's hands, with those of the patient on top, are gently pulled away providing large tactile stimulus to the patient's palms. A positive response is the gripping of the examiner's hands

Figure 1:
Signs of Frontal Dysfunction: The Noncognitive Neurologic Examination

Paratonia

An examination of tone in an individual with paratonia may reveal an inability to relax the limbs, with an inclination to resist passive movements in a persistent reflex fashion. The resistance seems to adjust to the force applied and to increase the more rapidly the limb is displaced. It affects the whole limb as opposed to particular muscle groups.



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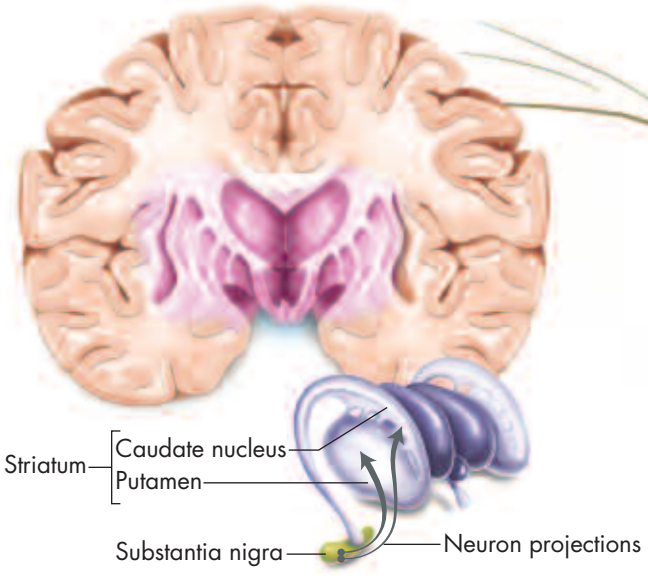

Body movements are controlled by signals that travel along neurons projecting from the substantia nigra to the caudate nucleus and putamen (collectively called the striatum). These neurons release dopamine in the striatum. Among individuals with Parkinson's, dopamine neurons in the nigro-striatal pathway degenerate.

that is persistent and reproducible. With well-developed tonic grasping, the examiner may have to exert some effort to withdraw her/his hands. Individuals with milder grasp responses can voluntarily inhibit the response, but when diverted it reappears, thus the advantage of the bimanual shake hands method. Instructing the patient not to grasp, as recommended in some texts, should be avoided.

Grasp reflexes and paratonia are associated with several complex motor behaviours that have been described with frontal lobe lesions and are attributed to cortical disinhibition. Patients are unable to suppress environmental distractions, a condition referred to as environmental dependence. In the most complex manifestations one sees a tendency to mimic the examiner, a phenomenon referred to as imitation behaviour, and an abnormal tendency to inappropriately take up and use instruments around them, referred to as utilization behaviour.[7] These are counterparts of the inability to avoid grasping or resisting passive movements of their own limbs and of motor perseveration.

Table 2: Global Deterioration Scale (GDS)

Stage 1: No cognitive decline
Experiences no problems in daily living.
Stage 2: Very mild cognitive decline
Forgets names and locations of objects.
May have trouble finding words.
Stage 3: Mild cognitive decline
Has difficulty travelling to new locations.
Has difficulty handling problems at work.
Stage 4: Moderate cognitive decline
Has difficulty with complex tasks (finances, shopping, planning dinner for guests).
Stage 5: Moderately severe cognitive decline
Needs help to choose clothing.
Needs prompting to bathe.
Stage 6: Severe cognitive decline
Needs help putting on clothing.
Requires assistance bathing; may have a fear of bathing.
Has decreased ability to use the toilet or is incontinent.
Stage 7: Very severe cognitive decline
Vocabulary becomes limited, eventually declining to single words.
Loses ability to walk and sit.
Becomes unable to smile.

Source: Reisberg B, et al., 1982[19] with permission of American Journal of Psychiatry.

Parkinsonism

Parkinsonism occurs early in dementia with Lewy bodies, late in AD, and at variable stages in vascular dementia and the frontotemporal lobar degenerations. It is the clinical syndrome reflecting impaired function of the nigrostriatal tract. The pathological basis for parkinsonism in AD remains unclear, but is likely to include Lewy body, AD, and vascular-associated pathologies separately or in combination.[8,9] The minimal diagnostic criteria include the presence of two of: rest tremor, bradykinesia, or rigidity. Indeed, the presence of rest tremor is virtually pathognomonic.

Bradykinesia

The ability to initiate and sustain rapid, full, repetitive, and serial movements is conveniently assessed with most sensitivity by looking at fine finger movements in the finger-wiggle or piano-playing maneuvers. Bradykinesia is present if there is slowing of initiation and sequencing of finger movements. Commonly, the individual starts with good movements only to have them break down in rate, range, and rhythm (known as digital impedance). In idiopathic Parkinson's disease it is usual for symptoms and signs to appear on one side, and the unaffected side serves as control.

Rigidity

Rigidity, the increased resistance to passive movement that characterizes parkinsonism, remains constant throughout the range of movement and does not change with the rate of the movement. Movements in the distal parts of the limbs are assessed because it is here that alterations of tone of all sorts are most likely to appear first. A useful manoeuvre to bring out subtle rigidity relies on the observation that activating corresponding muscles on the opposite side of the body will increase the rigidity. This is referred to as synkinetic enhancement and seems specific to parkinsonism.

The frontal signs described above and the frontal gait disorder occurring in late AD, vascular dementia, and frontotemporal lobar degenerations are often confused with true nigrostriatal parkinsonism. Paratonia is interpreted as rigidity, apraxia with bradykinesia, and the frontal gait disorder with a parkinsonian gait.[10]

Neuro-ophthalmologic Signs

Despite the distributed anatomy of visual function in the brain, and with two exceptions, neuro-ophthalmologic findings in the neurodegenerative dementias are uncommon, at least in the early stages. A variant of Alzheimer's disease called posterior cortical atrophy[11] is characterized by early occurrence of visuospacial perception, often fitting the Balint syndrome[12] of a spacial disorder of attention (simultagnosia), psychic paralysis of gaze (optic apraxia), and misreaching (optic ataxia). This is recognized when it is established that visual impairment cannot be explained by lesions of the anterior visual pathway (acuity and fields). The second exception is the eye movement disorder in progressive supranuclear palsy, now classified with the frontotemporal lobar dementias (discussed later). Vertical saccadic (voluntary) gaze should be checked. Individuals with frontal disorders will have difficulty fixing gaze on confrontation field testing (drawn to stimulus).

Focal and Lateralizing Signs of Cerebrovascular Lesions

The assessments described previously

Key Points

The finding of neurologic signs in addition to cognitive impairments in the mild and moderate stages of dementia suggests a diagnosis other than Alzheimer's disease.

For non-neurologists, a convenient algorithm for neurological examination tests diagnostic hypotheses for the common neurodegenerative dementias; namely Alzheimer's disease, dementia with Lewy bodies, vascular dementia, and the frontotemporal lobar degenerations.

The following are assessed or elicited: gait, frontal lobe signs, signs of parkinsonism, certain neuro-ophthalmologic signs, focal and lateralizing motor and sensory signs residual to stroke, and cortical and subcortical signs accompanying the many forms of frontotemporal lobar degenerations.

A complex neurologic syndrome is characteristic of the late stages of Alzheimer's disease.

will screen much neurological function, and prior cerebrovascular events are likely to have been characterized. Useful manoeuvres for screening motor and sensory function in addition to those mentioned previously are the following.

Motor System

Examine outstretched arms, palms down. Note posture, tremor (resting and action), drift (any direction), response to displacement, with eyes closed (Holmes test for excessive rebound). This is one of the most informative manoeuvres in the neurologic examination as is the examination of gait. Fine movements have been examined, and tone has been assessed as above.

In legs, test rapidity and range of foot tapping (slowed in Parkinson's disease and spasticity) and for clonus (brisk passive extensions of ankle). A sensitive test for spasticity is the Trömner reflex test for increased finger flexor stretch reflexes (does not require a hammer). Check plantar responses (leg straight to pick up triple response).

Sensory Testing

In the absence of a history of sensory symptoms or of findings requiring sensory examination for better anatomical localization, sample spinothalamic (perception of pinprick and cold) and posterior column function (128 Hz tuning fork). Light touch does not distinguish these functions. If balance and coordination are normal, then sense of passive movement (position sense) will not be impaired. Cortical sensory impairment and visual disturbances (Balint syndrome) are most unlikely to be present in the absence of suggestive history or other findings.

Signs Suggestive of Frontotemporal Lobar Dementias

The classification of frontotemporal lobar dementias (at one time known as Pick's disease) continues to expand as a group of individually uncommon disorders. At least 18 different disorders can be distinguished on pathological and genetic grounds.[13] Patients classified under this umbrella present with a change in personal and social conduct, often associated with disinhibition and gradual and progressive changes in language (progressive nonfluent aphasia and semantic dementia, a loss of the ability to understand the meaning of words). Added to these defining presentations are the frontal signs described above and other motor syndromes that include prominent apraxia (corticobasal degeneration), parkinsonism (frontotemporal lobar degeneration with MAPT (microtubule-associated protein tau) mutation, progressive supranuclear palsy) and motor neurone disease.

Neurological Findings in Advanced Alzheimer's Disease

People with AD who survive systemic disease lose not only cognitive function but experience a progressive loss of motor and sensoryperceptual functions. These motor losses affect not only cortical but also brain stem and bulbar functions so that if these individuals survive systemic complications they will eventually progress to a vegetative state in what Yakovlev described as "cerebral paraplegia in flexion."[14] This late stage is often complicated by the effects of neuroleptics and systemic disease, and is poorly characterized. Physicians caring for individuals with advanced dementia in long-term care facilities and other settings will be familiar with this course.

Reisberg and colleagues[15,16] have developed scales for staging the course of Alzheimer's disease (Table 2). The later stages (stages 6 and 7) imply major motor disability, which they have characterized subsequently in a standardized assessment. There was a very high prevalence of frontal release signs, parkinsonism, and corticospinal signs and this suggested "a characteristic neurologic syndrome."[17] This issue has been examined further in well-defined cohorts from several prospective studies using a modified Unified Parkinson's Disease Rating Scale.[18] Most of the motor signs assessed (except tremor) occurred frequently, and increased in occurrence and severity as the disease progressed over follow-ups of up to 13 years. The motor signs were associated with earlier adverse outcomes. Added to this complex neurology at the latest stages are myoclonus and a striking startle response readily demonstrated by a light but sharp tap to the tip of the nose. These reflect widespread cortical disinhibition.

Conclusion

With the increasing prevalence of dementia as populations age, and with the introduction of specific therapies, it becomes important that a wide range of practitioners develop skills in diagnosis. This will require familiarity with components of the neurologic examination focused on the common dementias.

These components will be manoeuvres that screen widely distributed functions of the cerebral hemispheres and detect features of characteristic of individual dementias. An examination designed to assess gait and detect signs of frontal lesions, parkinsonism, neuro-ophthalmologic abnormalities, focal and lateralizing signs and signs of frontotemporal lobar dementia is recommended to assist in the diagnostic characterization.

Dr. Wherrett currently holds contracts for research studies from Elan, GlaxoSmithKline, and Sanofi-Synthelabo.

References

1. Gladstone DJ, Black SE. The neurologic examination in aging, dementia and cerebrovascular disease. Geriatr Aging 2002;5:51–7.
2. Nutt JG, Marsden CD, Thompson PD. Human walking and higher-level gait disorders, particularly in the elderly. Neurology 1993;43:268–79.
3. Kleist K. Gegenhalten (Motorischer Negativismus) Zwangsgreifen und Thalamus Opticus. Monatschr Psychiat Neurol 1927;65:317–96.
4. Dupré E. Débilité mentale et débilité motrice associées. Rev Neurol 1910;20:54–56.
5. Hobbelen JSM, Koopmans RTCM, Verhey FRJ, et al. Diagnosing paratonia in the demented elderly: reliability and validity of the Paratonia Assessment Instrument (PAI). International Psychogeriatrics 2008 January [Epub ahead of print].
6. De Renzi E, Barbieri C. The incidence of the grasp reflex following hemispheric lesion and its relationship to frontal damage. Brain 1992;115:293–313.
7. Lhermitte, F. Patient behaviour in complex and social situations: The 'environmental dependency syndrome.' Ann Neurol 1986;19:335–43.
8. Burns JM, Galvin JE, Roe CM, et al. The pathology of the substantia nigra in Alzheimer disease with extrapyramidal signs. Neurol 2005:64;1397–1403.
9. Zijlmans JCM, Daniel SE, Hughes AJ, et al. Clinicopathological investigation of vascular parkinsonism, including clinical criteria for diagnosis. Move Dis 2004;19;630–40.
10. Kurlan R, Richard IH, Papka M, et al. Movement disorders in Alzheimer's disease: more rigidity of definitions is needed. Move Dis 2000;15:24–9.
11. Tang-Wai DF, Graff-Radford NR, Boeve BF, et al. Clinical, genetic, and neuropathologic characteristics of posterior cortical atrophy Neurology 2004;63:1168–74
12. Moreaud O. Balint syndrome. Arch Neurol 2003;60:1329–31.
13. Cairns NJ, Bigio EH, Mackenzie IRA, et al. Neuropathologic diagnostic and nosologic criteria for frontotemporal lobar degeneration: consensus of the consortium for frontotemporal lobar degeneration. Acta Neuropathol 2007;114:5–22.
14. Yakovlev PI. Paraplegia in flexion of cerebral origin. J Neuropath Exp Neurol 1954;13;267–96.
15. Reisberg B, Ferris SH, de Leon MJ, et al. Global Deterioration Scale (GDS). Psychopharmacol Bull 1988;24:661–3.
16. Reisberg B. Functional assessment staging (FAST). Psychopharmacol Bull 1988;24:653–9.
17. Franssen EH, Kluger A, Torossian CL, et al. The neurologic syndrome of severe Alzheimer's disease. Relationship to functional decline. Arch Neurol 1993;50:1029–39.
18. Scarmeas N, Hadjigeorgiou GM, Papadimitriou A, et al. Motor signs during the course of Alzheimer disease. Neurology 2004;63:975–82.
19. Reisberg B, Ferris SH, de Leon MJ, et al. The Global Deterioration Scale for assessment of primary degenerative dementia. Am J Psych 1982;139:1136–9.