Treatment

Treatment of bradykinesia, hypokinesia, and akinesia depends on the specific etiology and topography of the disorder.

Nonpharmacological strategies include sensory cues that can significantly improve performance and help to overcome and prevent freezing, when the dysfunction relies in the BG. Cues can be visual, such as striped lines on the walkways, and acoustic, such as the regularly paced beats of a metronome. These external cues substitute for the internally generated cues that are deficiently triggered in BG disorders, and theorically mainly affect akinesia. Their effect in hypokinesia and bradykinesia is different, with visual cues preferentially contributing to the enlargement of the stride, and acoustic cues mostly improving speed and step cadence. They are of no help in hypokinetic frontal gait disorders.

Pharmacological and surgical treatments of bradykinesia, hypokinesia, and akinesia are only available for parkinsonism with a predominant dopaminergic dysfunction of the BG, as in PD. The three phenomena are improved by dopaminergic stimulation, including treatment with levodopa or dopamine agonists. Also in PD, bilateral deep brain stimulation of the subthalamic nucleus has been shown to increase motor UPDRS scores. The differential effect of these therapeutic strategies in the different clinical phenomena is difficult to assess as most studies rely on UPDRS motor subscales that do not differentiate between them.

See also: Akinetic-Rigid Syndrome; Basal Ganglia; Basal Ganglia, Functional Organization; Dysarthria; Freezing of Gait; Gait Disturbances in Parkinsonism; Hypophonia; Micrographia; Parkinson's Disease: Definition, Diagnosis, and Management; Rigidity; Substantia Nigra; Unified Parkinson's Disease Rating Scale (UPDRS) and The Movement-Disorder Society Sponsored-unified Parkinson's Disease Rating Scale (MDS-UPDRS).

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http://www.wemove.org – We Move – Worldwide Education and Awarness for Movement Disorders.

Bradyphrenia

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Glossary

Diffusion tensor imaging – MRI-based imaging that assesses the structural integrity of white matter by measuring the rate and directionality of the displacement distribution of water molecules between tissues.

Information processing speed – The amount of time required to complete a cognitive task that also requires the manipulation of acquired knowledge.
Inspection time – The duration of exposure to a stimulus necessary for an individual to make a simple visual discrimination, for example, determine which of the two lines are longer, with near certain accuracy.

Processing speed – The length of time required to complete a cognitive task or the degree of cognitive output completed in a fixed period of time.
Psychomotor retardation – A visible deceleration of thought and movement.
Reaction time – A measure of duration from stimulus to response that can be classified as either simple (press a button when stimulus appears), recognition (press a button when certain stimuli appear, while ignoring others), or choice (press corresponding button when specific stimulus appears).
Response latency – The amount of time taken to respond after a stimulus, such as a question, is presented.
Subcortical dementia – A syndrome often accompanying movement disorders, consisting of but not limited to mental slowing, retrieval memory difficulties, working memory impairment, personality changes such as loss of motivation, affective changes such as depression and apathy, and marked frontal dysfunction such as loss of ability to initiate and sequence tasks.
Thought blocking – A sudden disruption in an individual's stream of thought interfering with its completion.
Working memory – The ability to sustain attention while manipulating acquired knowledge.

Definition

Bradyphrenia represents a pathological slowing in cognition. Synonymous with the historical term's 'psychic akinesia,' it is a highly sensitive although nonspecific indicator of cerebral dysfunction. Operational definitions depend on the measure used and include impairments in processing speed, information processing speed, complex attention, mental speed, reaction time, and inspection time.

Clinically the patient or caregiver endorses the patient's decreased productivity on timed tasks or the need to take longer time periods to complete mental process. Clinicians may observe increased response latency. Processing speed is a multifactorial construct, comprising speed of perception, processing, and response, the exact definition and objective measurement of which are challenging. The most elementary tasks tap multiple domains and are confounded by sensory and motor dysfunction. Consequently, bradyphrenia is best reported in the presence of cognitive slowing out of proportion to that expected from other contributing impairments.

Historical Context

Empirical measurements of processing speed emerged from the interest in individual intellectual differences suggested by evolutionary theory in the mid-nineteenth century. Sir Francis Galton, with subsequent contributions from Wundt, Cattell, Donders, and Burt, studied individuals' reaction times. They accurately hypothesized but failed to demonstrate intelligence correlating with processing speed. When their data were unable to predict students' grades, enthusiasm for the field waned.

In 1882, Ball first noted slowing of perception, movement, and ideas in parkinsonism. Following the encephalitis lethargica pandemic in the 1920s, Naville coined the term 'bradyphrenia,' known as 'bradypsyche' to German authors, to describe slowed intellectual processing in 40% of the patients. A lack of will and other psychological explanations for the psychiatric sequelae of parkinsonism dominated theories for the next 30 years.

The 1960s represented a renewed effort by experimental psychologists to uncover the heritability and neurophysiological underpinnings of the cerebral basis of 'psychic akinesia' as Hassler termed bradyphrenia. In 1964, Steele reported cognitive deficits in a series of patients with progressive supranuclear palsy. Albert later confirmed bradyphrenia in this population. Significant efforts ensued to characterize slowing in other disorders. In 1981, a processing speed index appeared in the Wechsler Adult Intelligence Scale demonstrating the importance of this measure to overall cognitive–intellectual functioning. However, working models of speed and intelligence as well as bedside and lab measures of bradyphrenia remain elusive.

Pathogenesis

Lesions of the medial neuraxis from frontal pole to pons, specifically the mesocortical pathway and reticular formation, were postulated as the injury site for psychic akinesia in the 1960s. However, no single brain lesion causes bradyphrenia. Its manifestation in subcortical dementias implicates a subcortical focus. However, it also occurs in cortical disease. Potential neurobiological correlates are suggested below.

White Matter Integrity

In multiple sclerosis, total lesion volume directly and independently predicts bradyphrenia. Patients with temporal lobe epilepsy with white matter volume reduction, survivors of severe traumatic brain injuries with quantitative corpus callosum deficiencies, and elderly subjects with more numerous white matter hyperintensities detected on MRI demonstrate clinically significant reductions in

processing speed. Recent diffusion tensor imaging data relate disruption of white matter pathways carrying efferent thalamocortical fibers to age-related cognitive slowing.

Frontal–Subcortical Dysfunction

Both hypokinetic and hyperkinetic basal ganglia disorders are associated with bradyphrenia. Frontally impaired individuals with Parkinson's disease (PD), nondemented subjects with caudate and thalamic lesions, and elderly patients with loss of the D_2 (dopamine)-receptor binding sites in the caudate and putamen manifest disproportionate processing speed deficiencies.

Neurotransmitter Changes

Reduced processing speed in various conditions has been linked to cholinergic deficits, hypodopaminergic states, and altered glutamate activity.

Clinical Assessment

Epidemiology

Factors such as age, baseline intelligence, cerebrovascular risk factors, and genetics modestly predispose individuals to cognitive slowing.

Presentation

The course of bradyphrenia may fluctuate or progress insidiously depending on the associated condition. Sudden arrests of movement in patients with parkinsonism may coincide with thought blocking. Clinical reports consistently associate thought blocking and response latency with reduced motivation, hypophonia, fatigue, apathy, poverty of speech and content, distractibility, perseveration, lack of awareness, and memory disturbance. Cognitive slowing impacts mobility, gait, balance, transitions from sitting to standing, driving competency, and functional reach. Processing speed correlates with functional and quality of life measures.

Bradyphrenia amplifies deficits in other cognitive functions including working memory, episodic memory, executive functioning, reasoning, verbal abilities, problem-solving, reading, arithmetic, and visuospatial skills. Inaccuracies from impairments in these domains in turn contribute to slowing. Despite these interactions, bradyphrenia independently affects performance even in patients with preserved overall intellectual functioning.

Associated Disorders

Table 1 lists some of the many clinical conditions in which bradyphrenia is present. The majority of research

Table 1 Conditions listed by etiology reporting bradyphrenia as a clinical characteristic

Congenital/genetic
Adrenoleukodystrophy
Choreoacanthocytosis
Fragile X tremor–ataxia syndrome
Metachromatic leukodystrophy
Myotonic dystrophy
Pediatric myelomeningocele with shunted hydrocephalus
Williams syndrome
Degenerative
Alzheimer's disease
Corticobasal degeneration
Guamanian parkinsonism–dementia complex
Hallervorden–Spatz disease
Huntington's disease
Mild cognitive impairment
Multiple system atrophy
Parkinson's disease
Progressive supranuclear palsy
Spinocerebellar atrophy
Developmental
Autism
Neurodevelopmental disorder
Iatrogenic
Electroconvulsive therapy, postictal
Idiopathic
Attention deficit and hyperactivity disorder
Bipolar affective disorder
Chronic fatigue syndrome
Epilepsy
Idiopathic basal ganglia calcification
Neuro-Behcet's disease
Normal pressure hydrocephalus
Reading disability
Schizophrenia
Infectious
Postencephalitis
AIDS dementia complex
Inflammatory
Central nervous system vasculitis
Multiple sclerosis
Sarcoidosis (subcortical)
Systemic lupus erythematosus
Metabolic/endocrine/nutritional
Diabetes
Hypoglycemia
Hypothyroidism
Hypoparathyroidism
Korsakoff's
Wilson's disease
Toxic
Substance use disorders (subacute)
Traumatic
Dementia pugilistica
Traumatic brain injury
Vascular
Binswanger's
Cardiovascular disease
Lacunar state
Thalamic infarction
Vascular dementia

studies focus on psychiatric syndromes, movement disorders, multiple sclerosis, and traumatic brain injury.

Conflicting evidence exists over the presence of generalized bradyphrenia in PD patients without dementia. Those with little or no dementia manifest disproportionately slower complex reaction times compared to Alzheimer's patients and elderly controls. The presence of dementia and increased task complexity predict processing speed impairments in the Parkinson's population. Disease duration and severity are not associated. Age, depression, and motor infirmity amplify bradyphrenia. Cognitive slowing contributes to disruptions in speech, mobility, sentence comprehension, executive function, and working memory.

Confounding Conditions

When assessing illnesses characterized by bradyphrenia in the elderly, age-related declines in processing speed require consideration. Cognitive slowing with age also mediates changes in memory, spatial ability, and executive function.

The overlap between psychomotor retardation in depression and bradyphrenia has long been appreciated. A common pathophysiological substrate appears likely. However, slowing in depression reflects more of an abulic or amotivational state, varying less as a function of task complexity compared to bradyphrenia. Phenomenological differences including tearfulness, guilt, suicidal thoughts, and hypochondriasis point to an affective etiology. Bradyphrenia is less likely to improve with antidepressant treatment when the conditions coexist.

Attempts to dissociate bradykinesia and bradyphrenia are long-standing, but have yielded conflictual results. Electrophysiological markers uncontaminated by patients' motor responses show slowing in mid and long-latency auditory evoked potentials delaying further with task complexity. Findings of motor but not cognitive speed improvements after dopamine replacement, and changes in processing speed on tasks requiring similar motor output but more complex decision-making also demonstrate that bradykinesia and bradyphrenia are dissociable phenomena.

Other variables masquerading as reduced processing speed include working memory impairments, apathetic frontal lobe symptomatology with delays in initiating self-generated responses, pathological indecisiveness in obsessive–compulsive disorder, and medication effects, especially due to anticholinergics.

Testing

No gold standard exists for the assessment of processing speed. Principles to guide accurate approximation include use of data from a wide variety of tests, interpretation of findings of processing speed in conjunction with performance on other measures, and minimizing confounding variables such as impairments in sensorimotor functioning, anxiety, impaired arousal, language, education or cultural biases, and practice effects. Table 2 lists various techniques of eliciting bradyphrenia.

Table 2 Tests for assessing processing speed

Bedside examination
Alphabet backwards
Alphanumeric sequencing: alternate counting with letters of alphabet
Letter fluency: name words beginning with certain letter in given time limit
Serial 7s: consecutively subtract seven from 100
Trail making test: draw line from numbers one through 25 (A) then alternate letters and numbers (B)
Psychomotor and psychophysical speed measures
Simple reaction time: press button in response to stimulus, for example, light
Recognition reaction time: respond to certain stimuli, for example, symbols by pressing button; ignore others
Choice reaction time: respond to identified stimuli, for example, letter on corresponding side
Inspection time: briefest target stimulation duration to score near-perfect recognition of stimulus, for example, which leg of Greek letter π (pi) is longer
Neuropsychological measures[a]
Adult memory and information processing battery: cross out second highest number in each row, timed
Paced auditory serial addition test: single digits presented serially must be summed to previous digit, interstimulus interval varied
Stroop: name color written in incongruous ink
Symbol digit modalities test (SDMT): write target number that matches one of nine geometric figures
Wechsler Adult Intelligence Scale-III digit symbol coding: SDMT but with symbols not figures
Wechsler Adult Intelligence Scale-III symbol search: scan search group of five symbols for presence of target group of two symbols
Computerized measures[b]
Auditory or visual threshold serial addition test: PASAT but report sum aloud while computer determines rate of stimulus presentation producing 50% success rate
Sternberg memory scanning test: memory set of one, two, or four digits, press one of two keys if digits on screen match digits in set
Electrophysiological measures[c]
P300 latency: oddball task – parietally distributed peak on EEG when low probability target stimulus easily discriminated from frequent nontarget stimuli
Alpha peak EEG frequency: fourier transformation performed on EEG time series may demonstrate slowing of alpha peak frequency

[a]When administered together a factor/index of processing speed may be formed.
[b]Most specific measures of processing speed.
[c]Experimental.

Management

Additional time to complete tasks and a greater focus on existing abilities such as verbal skills help compensate for

cognitive slowing. Processing speed training with computer-based target identification, detection, discrimination, and localization improves test measures, driving performance, and timed activities of daily living.

Confounding conditions including apathy and depression require treatment. Elimination of offending medications, minimization of cerebrovascular risk factors, and normalization of blood sugar and cobalamin levels are recommended. The underlying disorder demands optimum management. Empirical trials of psychostimulants and cholinomimetics may attenuate the profound functional impact of bradyphrenia.

See also: Anticholinergics and Movement Disorders; Binswanger's Subcortical Arteriosclerotic Encephalopathy; Bradykinesia; Chorea–acanthocytosis; Choreiform Disorders; Depression and Parkinsonism; Diffusion Tensor Imaging in Parkinson's Disease; Dopamine Receptors; Electroencephalography (EEG); Encephalitis Lethargica and Postencephalitic Parkinsonism; Executive Dysfunction; Hallervorden–Spatz Syndrome (PKAN); Huntington's Disease; Lupus Chorea; Metachromatic Leukodystrophy; Multiple System Atrophy; Normal Pressure Hydrocephalus; Obsessive-Compulsive Disorder; Parkinson's Disease: Definition, Diagnosis, and Management; Progressive Supranuclear Palsy; Reaction Time; Spinocerebellar Ataxias Genetics; Wilson's Disease.

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Brainstem Reticular Myoclonus

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Clinical Syndromes and Definitions

Myoclonus is defined as 'quick movement of muscle.' The resulting brief jerks are shock-like involuntary movements due to either a muscle contraction (positive myoclonus) or a brief interruption of contraction of active muscles (negative myoclonus). The term myoclonus initially included a variety of involuntary movements including tics. In 1903, Lundborg proposed the first classification to help specify this entity. Today, myoclonus can be classified based on clinical features, pathophysiology, or cause. On the basis of the clinical characteristics and electrodiagnostic studies, a relatively accurate site of origin in the nervous system can be predicted. Myoclonus can arise from the cortex, brainstem, spinal cord, and rarely from peripheral nerves. Those arising from the brainstem include exaggerated startle, reticular reflex myoclonus, and palatal myoclonus/tremor.

Exaggerated startle diseases or hyperekplexias (Greek for 'to startle excessively') refer to the brief, explosive, and overblown response to unexpected, mainly auditory stimuli but less frequently to visual or somesthetic stimuli. They were first described in 1958 by Kirstein and Silfverskiold; the definitive description in a large Dutch family occurred in 1966. Clinically, the hyperekplexias are characterized by three major features. A generalized