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APHASIA REHABILITATION

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Introduction

Aphasia is the acquired inability to communicate using written, spoken or sign language. Most people with aphasia experience difficulty in reading and writing. Aphasia can create psychological and interpersonal complications for the affected individual, as well as for family and friends. People with aphasia are usually aware of their limitations in communicating and the language barrier may lead to embarrassment, depression and relationship problems. It typically occurs after a stroke, head injury, brain tumour, infection or degenerative diseases leading to damage in areas of the brain cells controlling language. Stroke is the most common cause of aphasia, and it has been estimated that about 20-40% of stroke patients develop aphasia. (Wade et al 1986, Yavuzer et al., 2001). Recovery of aphasia after stroke can occur within a matter of hours or days following onset. There is a recent general consensus that the duration of spontaneous recovery can be extended up to six months post onset and various forms of speech and language therapies, particularly when used during spontaneous recovery, appear to have an impact on the evolution of this recovery pattern (Aftonomos et al 1997, Nicholas et al 1993).

According to the National Aphasia Association, the disorder affects about one in every 250 people, most commonly older individuals. It is estimated that in the US approximately 80,000 individuals become aphasic each year and that one million persons currently have aphasia. Risk for aphasia increased significantly with age, such that each advancing year was associated with 1-7% greater risk. While 15% of individuals under the age of 65 experienced aphasia, in the group of patients 85 years of age and older, 43% were aphasic (Engelter et al., 2006). On the other hand not enough data are available to evaluate differences in the incidence and clinical features of aphasia among gender and races.

The severity and scope of the problems depend on the extent of damage and the area of the brain affected. Initial stroke severity and lesion volume have been associated with initial severity of aphasia (Pedersen et al., 2004; Laska et al.; 2001, Ferro et al., 1999). Greater initial severity of aphasia is associated with poorer outcome. While some studies report recovery to be significantly better for younger patients (Ferro et al., 1999, Lasko et al., 2001), others report that age does not predict recovery (Pedersen et al., 2004). Similarly, while there are reported gender differences in type and severity of aphasia, sex does not predict recovery (Pedersen et al., 2004; Laska et al., 2001). Studies examining handedness, and education also provide conflicting results (Ferro et al., 1999; Berthier, 2005). Ninety-three percent of the population is right-handed, with the left hemisphere being dominant for language in 99% of right-handed individuals (Delaney and Potter, 1993). In left-handed individuals, 70% have language control in the left hemisphere, 15% in the right hemisphere, and 15% in both hemispheres (O'Brien and Pallet, 1978).

Language function is almost exclusively the domain of the left hemisphere; for 96.9% of the population language control is localized primarily in the left hemisphere.

Diagnosis

Aphasia is a symptom and not a disease; it can occur in a variety of types of brain injury and pathology. Therefore, the laboratory tests required depend on the underlying pathophysiology. The diagnosis of aphasia is based on physical examination and detailed mental state examination. Neuroimaging is required to localize a lesion in the left hemisphere or thalamus and diagnose the cause of aphasia. CT scanning and MRI are the mainstays of neuroimaging. CT effectively demonstrates acute bleeds and most strokes older than 48 hours; however, it may miss strokes less than 48 hours old. MRI with diffusion-weighted imaging detects strokes as early as an hour after onset. New imaging sequences such as the T2 or gradient echo imaging are sensitive to detection of hemorrhage, an early limitation of MRI technology. Contrast enhancement may be required to demonstrate tumors by both CT and MRI. Thin sections through the temporal lobes can demonstrate hippocampal atrophy or sclerosis, which are common in epilepsy and dementia. Coronal imaging on MRI is especially helpful in the detection of asymmetric hippocampal atrophy. At a time when gross atrophy of the tissue is hard to detect, PET and SPECT may be helpful in detecting hypometabolism or reduced cerebral blood flow, respectively, in dementing illnesses. These techniques are also useful in localization of epileptic foci. Functional MRI is increasingly being used in the study of normal activation of language structures in normal subjects. Early research is also aimed at discovering the patterns of recovery after neurologic injury such as a stroke with aphasia. EEG is important in patients with suspected seizures.

Although bedside examination can usually reveal the type of aphasia, formal cognitive testing by a neuropsychologist or speech/language therapist may be important to determine fine levels of dysfunction, to plan therapy, and to assess the patient's potential for recovery. This assessment must be broad enough to detect subtle disorders of language in patients in whom aphasia is suspected. Each component of language should be tested individually and thoroughly. Components of bedside language examination include assessments of spontaneous speech, naming, repetition, comprehension, reading, and writing. Neuropsychologists and speech/language therapists commonly administer classical language tests, including the Boston Diagnostic Aphasia Examination, the Western Aphasia Battery, the Boston Naming Test, the Token Test, and the Action Naming Test.

Types of aphasia

Type of aphasia is determined, primarily, by lesion location. The Boston classification system is used by researchers and clinicians to classify type of aphasias (Table 1) (Godefroy et al. 2002). Classic nosology of the perisylvian aphasias includes Broca, Wernicke, conduction, and global aphasias. The nonperisylvian aphasias include anomic, transcortical motor, transcortical sensory, and mixed transcortical, sometimes called the isolation of the speech area syndrome. Other more specific language syndromes include aphemia, alexia with and without agraphia, and pure word deafness. Subcortical aphasia syndromes are defined more by the anatomy of the lesion than by the language characteristics.

Global aphasia

Global aphasia is the most common type in the acute period resulting from damage to extensive portions of the language areas of the brain. It affects as many as 25-32% of aphasic patients, while other classic aphasias described within the Boston system of classification are seen less frequently (Laska et al., 2001; Godefroy et al., 2002; Pedersen et al., 2004). Individuals with global aphasia have severe communication difficulties and may be extremely limited in their ability to speak or comprehend language. Global aphasics can neither read nor write. Global aphasia may often be seen immediately after the patient has suffered a stroke and it may rapidly improve if the damage has not been too extensive. However, with greater brain damage, severe and lasting disability may result.

Broca's aphasia

In this form of aphasia, speech output is severely reduced and is limited mainly to short utterances of less than four words. Vocabulary access is limited and the formation of sounds by persons with Broca's aphasia is often laborious and clumsy. The person may understand speech relatively well and be able to read, but be limited in writing. Broca's aphasia is often referred to as a 'non fluent aphasia' because of the halting and effortful quality of speech. Individuals with Broca's aphasia have damage to the frontal lobe of the brain. These individuals frequently speak in short, meaningful phrases that are produced with great effort. Broca's aphasia is thus characterized as a nonfluent aphasia. Individuals with Broca's aphasia are able to understand the speech of others to varying degrees. Because of this, they are often aware of their difficulties and can become easily frustrated by their speaking problems. Individuals with Broca's aphasia often have right-sided weakness or paralysis of the arm and leg because the frontal lobe is also important for body movement.

Mixed non-fluent aphasia

This term is applied to patients who have sparse and effortful speech, resembling severe Broca's aphasia. However, unlike persons with Broca's aphasia, they remain limited in their comprehension of speech and do not read or write beyond an elementary level.

Wernicke's aphasia

In this form of aphasia the ability to grasp the meaning of spoken words is chiefly impaired, while the ease of producing connected speech is not much affected. Therefore Wernicke's aphasia is referred to as a 'fluent aphasia.' However, speech is far from normal. Sentences do not hang together and irrelevant words intrude-sometimes to the point of jargon, in severe cases. Reading and writing are often severely impaired. In contrast to Broca's aphasia, damage to the temporal lobe may result in a fluent aphasia that is called Wernicke's aphasia. Individuals with Wernicke's aphasia may speak in long sentences that have no meaning, add unnecessary words, and even create new words. Individuals with Wernicke's aphasia usually have great difficulty understanding speech and are therefore often unaware of their mistakes. These individuals usually have no body weakness because their brain injury is not near the parts of the brain that control movement.

Anomic aphasia

This term is applied to persons who are left with a persistent inability to supply the words for the things they want to talk about-particularly the significant nouns and verbs. As a result, their speech, while fluent in grammatical form and output, is full of vague circumlocutions and expressions of frustration. They understand speech well, and in most cases, read adequately. Difficulty finding words is as evident in writing as in speech.

Other varieties of aphasia

In addition to the foregoing syndromes that are seen repeatedly by speech clinicians, there are many other possible combinations of deficits that do not exactly fit into these categories. Some of the components of a complex aphasia syndrome may also occur in isolation. This may be the case for disorders of reading (alexia) or disorders affecting both reading and writing (alexia and agraphia), following a stroke. Severe impairments of calculation often accompany aphasia, yet in some instances patients retain excellent calculation in spite of the loss of language.

Differential diagnosis of aphasia

There are a variety of communication disorders that may be due to paralysis, weakness, or incoordination of the speech musculature or to cognitive impairment. Such impairment may accompany aphasia or occur independently and be confused with aphasia. It is important to distinguish these disorders from aphasia because the treatment(s) and prognosis of each disorder are different. Communication disorders that can appear following stroke or other brain injury include aphasia, apraxia of speech and oral apraxia. At times, it may be difficult to identify which of these conditions a survivor is dealing with, particularly since it is possible for all three to be present at the same time.

Apraxia of speech

A collective term used to describe impairment in carrying out purposeful movements. Frequently used by speech pathologists to designate an impairment in the voluntary production of articulation and prosody (the rhythm and timing) of speech. It is characterized by highly inconsistent errors. Specific examination usually shows that they are unable to perform common expressive gestures on request, such as waving good-bye, beckoning, or saluting, or to pantomime drinking, brushing teeth, etc. (limb apraxia). Apraxia may also primarily affect oral, non-speech movements, like pretending to cough or blow out a candle (facial apraxia). This disorder may even extend to the inability to manipulate real objects. More often, however, apraxia is not very apparent unless one asks the patient to perform or imitate a pretended action. For this reason it is almost never presented as a complaint by the patient or the family. Several different intervention strategies are undertaken by speech and language therapists working with this patient group. However there is no evidence from randomised trials to support or refute the effectiveness of therapeutic interventions for apraxia of speech. (West et al., 2005)

Dysarthria

Dysarthria is a disorder of speech production not language which refers to a group of speech disorders resulting from weakness, slowness, or incoordination of the speech mechanism due to damage to any of a variety of points in the nervous system. Unlike apraxia of speech, the speech errors that occur in dysarthria are highly consistent. Dysarthria may involve disorders to some or all of the basic speech processes: respiration phonation, resonance, articulation, and prosody.

Dementia

A condition of impairment of memory, intellect, personality, and insight resulting from brain injury or disease. Some forms of dementia are progressive, such as Alzheimer's disease, Picks disease, or some forms of Parkinson's disease. Language impairments are more or less prominent in different forms of dementia, but these are usually overshadowed by more widespread intellectual loss. Since dementia is so often a progressive disorder, the prognosis is quite different from aphasia.

Other problems to be considered

Developmental disorders, encephalopathy/delirium, Locked-in state (due to central pontine myelinolysis), mutism, psychiatric diseases.

Prognosis

The prognosis for language recovery varies depending on the size and nature of the lesion and the age and overall health of the patient. A left hemisphere glioblastoma may be associated with a very short life expectancy, whereas a minor stroke may have an excellent prognosis. It is the underlying pathology, not the aphasia itself that determines prognosis.

In general, patients with preserved receptive language functions are better candidates for rehabilitation than are those with impaired comprehension. The potential for functional recovery from primarily expressive aphasia (ie, Broca aphasia) after a stroke is excellent, for recovery from a Wernicke-type aphasia due to a stroke is not as good as that for Broca aphasia. The potential for recovery from aphasia due to an untreatable tumor or neurodegenerative disease is poor.

Treatment

If the brain damage is mild, a person may recover language skills without treatment. However, most people undergo speech and language therapy to rehabilitate their language skills and supplement their communication experiences. Recovery of language skills is usually a relatively slow process, and few people regain pre-injury communication levels. If the symptoms of aphasia last longer than two or three months after a stroke, a complete recovery is unlikely. The primary treatment for aphasia is speech therapy that focuses on relearning and practicing language skills and using alternative or supplementary communication methods. Speech therapy is often provided to persons with aphasia, but does not guarantee a "cure". The purpose of speech therapy is to help the patient to fully utilize remaining skills and to learn compensatory means of communication.

Improvement is a slow process that usually involves both helping the individual and family understand the nature of aphasia and learning compensatory strategies for communicating. Patients' families are very important in the rehabilitation process. In the recovery from aphasia the importance of an interested spouse, family or communication partner and environmental support cannot be discounted. Some of the potentially negative reactions of the family are overprotectiveness, hostility, anger, unrealistic expectations, lack of knowledge of the dimensions of the disorder and inability to cope with practical difficulties (Sarno, 1998; Croteau and Dorze, 1999). The apparently natural tendency of family members to minimize the patient's communication impairment particularly in the early stages of recovery requires understanding and tactful management (Sarno, 1998). In addition to improving the patients' communication, it has to be aimed to support the family and friends as well.

Language Therapy

Language therapy is efficacious in treating aphasia when provided intensely; less intensive therapy given over a longer period of time does not provide a statistically significant benefit, although clinical benefits can be achieved. A recent study had determined that intense aphasia therapy over a short period of time has greater impact on recovery than less intense therapy over a longer period of time. (Bhogal, 2003). Trained volunteers can provide an effective adjunct to speech-language pathologists' treatment. Group therapy for aphasic patients is a potential means to maximize limited language therapy resources and encourage social interactions. Participation in group therapy may result in communicative and linguistic improvements. Language outcomes at both the impairment and disability level are independent of severity, setting, diagnostic type or stage of aphasia. Community-based language therapy programs provide a setting for improved language functions taking into account limitations and constraints of the real-world. Educational seminars for aphasic individuals and their families/caregivers may improve not only knowledge, but may also be beneficial in terms of social participation and family adjustment. In a group setting, people with aphasia can try out their communication skills in a safe environment. Participants can practice initiating conversations, speaking in turn, clarifying misunderstandings and fixing conversations that have completely broken down. Participating in real-life situations — such as going to a restaurant or a grocery store — puts rehabilitation efforts into practice.
Family members are encouraged to simplify language by using short, uncomplicated sentences; repeat the content words or write down key words to clarify meaning as needed; maintain a natural conversational manner appropriate for an adult; minimize distractions, such as a blaring radio, whenever possible; include the person with aphasia in conversations; ask for and value the opinion of the person with aphasia, especially regarding family matters; encourage any type of communication, whether it is speech, gesture, pointing, or drawing; avoid correcting the individual's speech; allow the individual plenty of time to talk; help the individual become involved outside the home; seek out support groups such as stroke clubs.

Computer-Based Treatment of Aphasia

Computer-Based Treatment of Aphasia can improve language skills assessed at the impairment level; however it is not clear that improvements made via computer-based intervention generalize to functional communication. Computer-based aphasia therapy results in improved language skills and may improve functional communication.

Forced-use aphasia therapy

Forced-use aphasia therapy can result in improved language function and everyday communication in chronic aphasics over a short period of time.

Repetitive Transcranial Magnetic Stimulation (rTMS)

Repetitive Transcranial Magnetic Stimulation (rTMS) is a non-invasive procedure that uses a rapidly fluctuating magnetic field to “create electrical currents in discrete areas of the brain” (Martin et al., 2004). Multiple stimuli can be used to increase or decrease the excitability of the affected cortex, temporarily. In stroke patients with nonfluent aphasia, functional MRI studies have revealed unusually high levels of right-sided cortical activation during language tasks (Rosen et al., 2000; Martin et al., 2004; Naeser et al., 2004; Naeser et al., 2005). While the potential importance of activation of the right frontal cortex in language recovery can not be dismissed (Rosen et al., 2000); it has also been suggested that this unusually high level of activation is not necessarily associated with improved language performance, but rather may be a maladaptive strategy that hinders aphasia recovery in non-fluent patients (Rosen et al., 2000; Martin et al., 2004; Naeser et al., 2004; Naeser et al., 2005). Recent studies have examined the effectiveness of the application of slow rTMS to reduce excitability in right-sided Broca’s homologue in improving naming function in patients with nonfluent aphasia. There is limited evidence that treatment with slow repetitive transcranial magnetic stimulation to the anterior portion of right Broca’s homologue is associated with improved naming performance in patients with chronic, nonfluent aphasia. As this is based on preliminary studies only, further investigation is required. Treatment with repetitive transcranial magnetic stimulation may be associated with improved naming performance in patients with non-fluent, chronic aphasia.

Drug Therapy in Aphasia

Piracetam is a γ-aminobutyrate derivative, a pharmacological agent with a potential effect on cognition and memory. Piracetam is thought to improve learning and memory by facilitating release of acetylcholine and excitatory amino acids, with increases in blood flow and energy metabolism (Kessler et al., 2000). In a Cochrane review of 52 studies only piracetam had some beneficial effects on language abilities when given to people with aphasia following stroke (Greener 2001). The authors identified 10 studies that were suitable for review. Drugs that were used in the selected trials were piracetam, bifemalane, piribedil, bromocriptine, idebenone and Dextran-40. However, it should be noted that the only pharmacological treatment for aphasia available in Canada is bromocriptine. The authors found that in most trials, the methodological quality was not measurable with only one study providing adequate data for review and analyses.

Bromocriptine is a dopaminomimetic ergot derivative with D2-type receptor antagonist properties. It is primarily regarded as a dopamine agonist. Based on three good quality RCTs there is strong evidence that Bromocriptine does not improve aphasia recovery post-stroke.

The *amphetamines* belong to the general group of sympathomimetic amines. Effective doses can enhance of performance and wakefulness, decrease feelings of fatigue, increased alertness and mood (euphoria) in humans. Methylphenidate, an amphetamine, blocks the reuptake of serotonin and norepinephrine, and has dopaminergic activity as well. There is moderate evidence that dextroamphetamine improves aphasia recovery when combined with language therapy.

Surgery has been successful in those occasions where pressure from a brain tumor or a hematoma impacts a critical speech center. Surgery is not useful in cases of aphasia following stroke, which represent the vast majority of instances.

Table: Characteristic Features of Aphasia

<table>
<tr><th>Type of aphasia</th><th>Repetition</th><th>Naming</th><th>Auditory comprehension</th><th>Fluency</th><th>Presentation</th></tr>
<tr><td>Wernicke's aphasia</td><td>mild–mod</td><td>mild–severe</td><td>defective</td><td>fluent paraphasic</td><td></td></tr>
<tr><td colspan="6">Individuals with Wernicke's aphasia may speak in long sentences that have no meaning, add unnecessary words, and even create new "words" (neologisms). For example, someone with Wernicke's aphasia may say, "You know that smoodle pinkered and that I want to get him round and take care of him like you want before", meaning "The dog needs to go out so I will take him for a walk". They have poor auditory and reading comprehension, and fluent, but nonsensical, oral and written expression. Individuals with Wernicke's aphasia usually have great difficulty understanding the speech of both themselves and others and are therefore often unaware of their mistakes. They are also often unaware of their surroundings, and may present a risk to themselves and others around them.</td></tr>
<tr><td>Transcortical sensory aphasia</td><td>good</td><td>mod–severe</td><td>poor</td><td>fluent</td><td></td></tr>
<tr><td colspan="6">Similar deficits as in Wernicke's aphasia, but repetition ability remains intact.</td></tr>
<tr><td>Conduction aphasia</td><td>poor</td><td>poor</td><td>relatively good</td><td>fluent</td><td></td></tr>
<tr><td colspan="6">Caused by damage to the arcuate fasciculus, the structure that transmits information between Wernicke's area and Broca's area. Auditory comprehension is near normal, and oral expression is fluent with occasional paraphasic errors. Repetition ability is poor.</td></tr>
<tr><td>Anomic aphasia</td><td>mild</td><td>mod–severe</td><td>mild</td><td>fluent</td><td></td></tr>
<tr><td colspan="6">Anomic aphasia, is essentially a difficulty with naming. The patient may have difficulties naming certain words, linked by their grammatical type (e.g. difficulty naming verbs and not nouns) or by their semantic category (e.g. difficulty naming words relating to photography but nothing else) or a more general naming difficulty. Patients tend to produce grammatic, yet</td></tr>
</table>

<table>
<tr><td colspan="6">empty, speech. Auditory comprehension tends to be preserved.</td></tr>
<tr><td>Broca's aphasia</td><td>mod–severe</td><td>mod–severe</td><td>mild difficulty</td><td>non-fluent, effortful, slow</td><td></td></tr>
<tr><td colspan="6">Individuals with Broca's aphasia frequently speak short, meaningful phrases that are produced with great effort. Broca's aphasia is thus characterized as a nonfluent aphasia. Affected people often omit small words such as "is", "and", and "the". For example, a person with Broca's aphasia may say, "Walk dog" meaning, "I will take the dog for a walk". The same sentence could also mean "You take the dog for a walk", or "The dog walked out of the yard", depending on the circumstances. Individuals with Broca's aphasia are able to understand the speech of others to varying degrees. Because of this, they are often aware of their difficulties and can become easily frustrated by their speaking problems. It is associated with right hemiparesis, meaning that there will be paralysis of the patient's right arm, leg, and face.</td></tr>
<tr><td>Transcortical motor aphasia</td><td>good</td><td>mild–severe</td><td>mild</td><td>non-fluent</td><td></td></tr>
<tr><td colspan="6">Similar deficits as Broca's aphasia, except repetition ability remains intact. Auditory comprehension is generally fine for simple conversations, but declines rapidly for more complex conversations. It is associated with right hemiparesis, meaning that there will be paralysis of the patient's right arm, leg, and face.</td></tr>
<tr><td>Global aphasia</td><td>poor</td><td>poor</td><td>poor</td><td>non-fluent</td><td></td></tr>
<tr><td colspan="6">Individuals with global aphasia have severe communication difficulties and will be extremely limited in their ability to speak or comprehend language. They may be totally nonverbal, and/or only use facial expressions and gestures to communicate. It is associated with right hemiparesis, meaning that there will be paralysis of the patient's right arm, leg, and face.</td></tr>
<tr><td>Transcortical mixed aphasia</td><td>moderate</td><td>poor</td><td>poor</td><td>non-fluent</td><td></td></tr>
<tr><td colspan="6">Similar deficits as in global aphasia, but repetition ability remains intact.</td></tr>
<tr><td>Subcortical aphasias</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">Characteristics and symptoms depend upon the site and size of subcortical lesion. Possible sites of lesions include the thalamus, internal capsule, and basal ganglia.</td></tr>
</table>

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