REVIEW

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Communication disturbances in neurology

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Abstract: Various disorders may impair the ability of a person to communicate. These disorders may involve voice, speech, language, hearing, and cognition. Recognizing and addressing communication disorders became an important in clinical disciplines especially in behavioral neurology as an informative part of diagnostic puzzle.
In this paper a bunch of language and communication symptoms were addressed in constellation with neurodegenerative diseases.
Motor aspect of language, aphasia and cognitive-communicative disorders were given special attention.

Key words: language, cognition, communication

Communication. Communication is a multidimensional dynamic process that allows human beings to interact with their environment. Through communication, people are able to express thoughts, needs and emotions [1]. Communication is an intricate process that involves cerebration, cognition, hearing, speech production and motor coordination [2]. Evaluation of a communication disorder includes consideration of all aspects of the normal communication process.

Various disorders may impair the ability of a person to communicate. These disorders may involve voice, speech, language, hearing, and/or cognition. Recognizing and addressing communication disorders is important; failure to do so may result in isolation, depression and loss of independence [3].

Language and cognition in the process of communication. Language is the transformation of thoughts into meaningful symbols communicated by speech, writing or gestures. Thoughts are organized by the brain, specifically the left hemisphere, and encoded into a sequence according to learned grammatical and linguistic rules. These rules govern the way sounds are organized (phonology), the meaning of words (semantics), how words are formed (morphology), how words are combined into phrases (syntax), and the use of language in context (pragmatics) [3, 4, 5].

Motor aspect of language-speech. The production of speech depends on motor coordination of the structures of the respiratory system, larynx, pharynx and oral cavity [4, 5]. Speech involves the coordinated motor activity of muscles involved in respiration, phonation, resonance and articulation. The entire system is modulated by both central and peripheral innervation, including the cranial nerves V, X, XI and XII, as well as the phrenic and intercostal nerves [6, 7]. Respiratory muscles, specifically the muscles associated with expiration, must generate enough air pressure to provide adequate breath support to make speech audible. The diaphragm is the main muscle of inspiration; however, the abdominal and intercostal muscles help control the force and length of exhalation for speech. Phonatory muscles of the larynx generate vibratory energy during vocal cord approximation to produce sound. Vocal pitch and intensity are modified by subglottic air pressure, tension of the vocal cords, and position of the larynx. Articulatory muscles within the pharynx, mouth and nose form the tone of the sound. The coordinated action of these muscles produces speech [5, 7]. By altering the shape of the vocal tract, we are capable of producing a tremendous range of sounds. Sound waves are transformed by the auditory system into neural input for both the speaker and the listener. The outer ear detects sound pressure waves in the air and converts them into mechanical vibrations in the middle and inner ear. The cochlea then transforms these mechanical vibrations into vibrations in fluid, which act on the nerve endings of the eighth cranial nerve. Thus, the process of communication begins and ends in the brain. The voice is the audible sound produced by the passage of air through the larynx. Voice typically is defined by the elements of pitch (frequency), loudness (intensity), and quality (complexity). By varying the pitch, loudness, rate and rhythm of voice (prosody), the speaker can convey additional meaning and emotion to words. A voice disorder exists when the quality, pitch, or volume differs from that of other persons of similar age, culture, and geographic location. Dysphonia is classified either as an organic or functional disorder of the larynx. Organic disorders cause an interruption in the smooth approximation of the vocal folds. Such disorders include the following: vocal nodules, laryngitis, laryngeal and esophageal tumours, contact ulcers, vocal cord paralysis, chronic obstructive pulmonary disease, or surgery. Functional disorders affect the quality and volume of the voice. They include the following: vocal abuse/misuse, screaming, excessive throat clearing, substance abuse (eg, smoking, alcohol) as well as normal aging, psychosocial disorders, hysterical conditions, and conversion voice impairment [4, 5, 6].

Disorders of motor speech are classified into dysarthrias and apraxias. Dysarthria is the collective name for a group of motor speech disorders caused by a disturbance in the neuromuscular control of speech, due either to central or peripheral nervous system damage manifested as weakness, slowness, or uncoordinated speech. Any or all of the normal motor structures may be involved [8, 9]. Unless a concomitant

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language disorder exists, a person with dysarthria has intact comprehension and is able to understand written and spoken language, and read [10, 11, 12, 13]. The diagnosis of dysarthria is made clinically by assessing the pitch, nasality, articulation, rate, and intelligibility of the patient's speech [10, 11, 12]. Additionally, each of the subsystems of speech (neurological, respiratory, laryngeal, pharyngeal, and oral structures) must be assessed [11, 12]. There are a few dysarthria tests available to assess all those features. If the native language is English, speech intelligibility tests such as Assessing Intelligibility of Dysarthric Speech can be administered [10]. Mirecka and Gustaw [14] developed a tool for assessing dysarthria in a specific group of patients using Polish as the native language.

The second category of motor speech disorders is apraxia. Apraxia is a disorder with the capacity to programme the positioning of the speech musculature and sequence the movements necessary for speech [9]. Apraxia occurs in the presence of significant weakness or uncoordination of the muscles of speech production. The following two types of apraxia related to speech disorders are recognized: 1) oral apraxia and 2) apraxia of speech [9, 10]. Oral apraxia is an apraxia of nonverbal oral movements. Patients have difficulty performing movements such as sticking out their tongues, licking their lips, and protruding their lips. Lesions of the premotor cortex are a frequent finding in patients with this disorder [9, 10]. Apraxia of speech is a disorder of articulation that encompasses the intonation, rhythm and stress of speech (prosody). These patients have difficulty planning, initiating, and sequencing speech movements accurately. Typically, apraxia of speech occurs with left frontal lesions adjacent to the Broca area. The following characteristics are usually present: strenuous, groping articulatory movements with attempts at self-correction, dysprosody, unrelieved by extended periods of normal intonation, rhythm, and stress, articulatory inconsistency or repeated production of the same utterance, difficulty initiating an utterance.

Diagnosis is made clinically, based on the above characteristics. Additionally, apraxia of speech may be differentiated from dysarthria and aphasia because in apraxia of speech, automatic speech, motor control and other language modalities (ie, listening, reading, writing) all are spared [10, 13].

Language disorders-aphasia. Aphasia is a language disorder that results from damage to the areas of the brain responsible for language comprehension and expression [1, 15]. Usually, these injuries occur in the dominant side of the brain which, for most people, is the left hemisphere. Depending on the site of the lesion, aphasia may involve spoken and written language expression, auditory comprehension, and reading and writing abilities. Aphasia may be described by a variety of abnormalities of speech production.

Aphasias are classified in several ways. Traditionally, aphasia syndromes were classified as expressive or receptive. Individuals with expressive or motor aphasia had difficulty producing words and were believed to suffer a lesion in the Broca area in the dominant frontal lobe. Patients with receptive, or sensory, aphasia have difficulty comprehending language and are thought to have a lesion in the Wernicke area of the dominant temporal lobe [2, 3]. Modification of the classification system was proposed based on the fluency, or rate of speech. Fluent speech is produced at normal to rapid rates and is effortless and well articulated. Nonfluent speech is slow, laboured, and poorly articulated. As a rule, lesions anterior to the fissure of Roland produce nonfluent aphasias; lesions posterior to this fissure produce fluent aphasias [4]. Newer brain imaging techniques, however, have shown that both the subcortical and right hemispheric structures also contribute to language functions. The traditional classification systems are limited in that they classify the types of disorders according to the site of lesion in the dominant cortical hemisphere only. The currently accepted classification system evaluates fluency, comprehension and repetition, and divides the aphasias into cortical and subcortical forms. The advent of computed tomography scan and MRI has enhanced our ability to identify small subcortical lesions as causes of aphasia. The following two major forms of subcortical aphasias are recognized: thalamic, and those due to lesions in the caudate, putamen, and/or internal capsule [15, 16]. Thalamic aphasia generally consists of fluent speech, mild impairment in comprehension and intact repetition. Paraphasias, neologism, perseveration and fluctuating attention are also common in thalamic aphasia. Lesions involving the putamen and caudate, with extension into the internal capsule, may cause several aphasic syndromes. The core syndrome is one of relative intact fluency, comprehension, and repetition. Depending upon the extent and location of the lesion, the syndrome may include better or worse articulation and comprehension, apraxia, and paraphasias. Evaluation of aphasia should be performed by a formal standardized assessment of the components of language. Tests are designed to evaluate the patient's receptive and expressive language capacities by sampling components such as conversational speech, comprehension, repetition, naming, reading, and writing [3, 16, 17].

Cognitive-communicative disorders. This group of disorders affect the ability to communicate by impairing the pragmatics, or social rules of language. The cognitive processes involved include the following: orientation, attention, perception, memory, organization, impulsiveness, reasoning, recall, planning and sequencing, and social behaviour [1, 3]. Cognitive-communicative impairments occur primarily with the following conditions: right hemisphere dysfunction, traumatic brain injury dementia. Patients with right hemisphere lesions have relatively intact language, but demonstrate impaired overall communication abilities [20, 21]. Common deficits seen in right hemisphere lesions are visuospatial processing, insensitivity to context (missing subtleties), impulsiveness, difficulty with expression and reception of emotions, lack of effective aspects (vocal inflection, no facial expressions), impaired conversational rules (turn taking) left-sided neglect, poor topic maintenance (tangential), unawareness of deficits, and failure to recognize humour. These impairments often cause patients to be considered difficult to get along with, rude, indifferent, or depressed [3, 21, 22].

Patients with traumatic brain injury may experience a variety of communication disorders, including aphasia, dysarthria, apraxia, and stuttering. Most typical are disturbances of perception, behaviour, information retrieval, memory, and executive functioning. Social difficulties are common, due to impaired social perceptiveness, self-regulation, emotional lability, and perseveration. Expressive language deficits often include confabulation, circumloculation, and verbosity [3, 4, 21]. Patients with traumatic brain injury often show deficits

in perception, language and memory; therefore, all these modalities should be evaluated. As patients recover, they generally demonstrate progressive improvement in cognitive functioning. Since recovery is a dynamic process, patients with traumatic brain injury should be tracked serially by a neuropsychologist to help guide the treatment plan. Treatment of the cognitive-communicative deficits of patients with traumatic brain injury requires special considerations. Most patients with traumatic brain injury are under 30 years of age, and have the potential to return to the workforce. Although initially the patient benefits from traditional rehabilitation techniques, he or she requires additional focus in the areas of orientation, memory, attention, and self-regulation. Additionally, the patient's environment should be structured in order that predictability reinforces memory. Lastly, generalization to real world settings is necessary during therapy if re-entry into the community is to be successful [2, 22].

Dementia on the other hand, results in generalized intellectual impairment that compromises communication ability [21, 22]. A result of diffuse bilateral damage, dementia may be cortical and/or subcortical. The severity of language impairment is associated with impairment in other mental functions [23]. Patients with dementia often are classified into the following stages:

- Early stage:
  - the person is least affected;
  - some difficulties with pragmatics, orientation, and word finding.
- Middle stage:
  - further deterioration from the above description;
  - additional disruption of grammar present.
- Late stage:
  - progression to global impairment with all components of language affected;
  - speech becomes mainly neologistic and echolalic and eventually disappears;
  - patient becomes mute [23, 24, 25 26, 27].

Assessment of the demented patient should include a full history and physical examination, as well as formal testing. The Mini Mental Status examination can be administered quickly and easily [28]. The researcher can administer the Arizona Battery for Communication Disorders of Dementia to assess communicative deficits. Assessment should be performed at regular intervals to follow progression of the patient [29].

Dementia is progressive and diffuse; therefore, the treatment is supportive. Treatment goals should include environmental controls, capitalization on any preserved memory, and family training. The ability to hear is an integral part of the normal communication process [30, 31, 32] and is extremely important because impaired ability to relate to sounds can result in social isolation, depression, avoidance, and diminished quality of life.

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