THE PRIMARY CARE Optometric Examination of the APHASIC PATIENT

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Abstract

This article discusses the different types of aphasia, and the primary care optometric examination of an aphasic patient. An overview of the language areas of the brain is presented in order to have a complete understanding of the communication deficits a patient with a certain brain lesion may have and how this may affect the examination of this patient.

Key Words

aphasia, language, cerebrovascular accident, traumatic brain injury, brain processing

Aphasia is a term which represents a broad class of speech and language dysfunctions caused by neurological damage.[1] It is a defect or loss of the ability to communicate by speech, writing, or signs, or comprehending spoken or written language due to injury or disease of the brain centers.[2] It is an acquired impairment in the ability to process and/or produce language which affects auditory comprehension, reading ability, verbal expression, and writing, depending on the neuroanatomic site and extent of the lesion.[3,4]

Cerebrovascular accident (CVA) or stroke is the most common cause of aphasia in the adult population, accounting for as many as half of all aphasia cases.[5] There are approximately 500,000 new cases of stroke per year in the United States[6,7] and it's estimated that 20% of these patients will have some form of aphasia. Traumatic brain injury (TBI) is the next most common cause of sudden-onset aphasia accounting for about one third of all cases. While the incidence of stroke in the United States is declining due to better control of hypertension and healthier lifestyles, aphasia secondary to head injury is increasing. There are more than 450,000 cases of closed head injury requiring hospitalization each year in the United States and as many as one third of these patients will have some type of speech or language disorder.[5] Other causes of aphasia include tumors, dementing illnesses, degenerative neurological disorders, central nervous system infections, chemical toxicities, and nutritional deficiencies.[8,9,10]

Right Hemisphere vs. Left Hemisphere

The brain is divided into the right and left hemispheres. Each hemisphere is comprised of specialized areas of function and overall contributes differently to the way that information is processed.[11] In general, damage to the left hemisphere is more likely to result in language deficits where damage to the right hemisphere will more likely result in visual-perceptual or visual-spatial deficits.[12]

The left hemisphere is a local, successive, and temporal processor.[13] It processes information sequentially and treats the individual components rather than the whole.[14] It is believed that the language center for 97% of the population resides in the left cerebral hemisphere.[15] This makes sense as the left hemisphere has superior analytical skills which are necessary for the understanding and production of language.[11] More specifically, 99% of all right-handed adults are left hemisphere dominant for language. About 60% of left-handers are left hemisphere dominant for language, 30% are right hemisphere dominant and 10% have language competence in both hemispheres.[16] In addition, the left hemisphere controls motor movements of the right side of the body.[13] Therefore, damage to the left hemisphere can result in a paresis or paralysis of the right side of the body.[17]

The right hemisphere is a global, spatial, and simultaneous processor. It is specialized in the analysis of spatial and visual information. Patients with right hemispheric damage often present with visual attention deficits, difficulty with spatial orientation, visual closure (recognizing faces) and figure-ground analysis.[13] The right hemisphere controls motor movements of the left side of the body; therefore, damage can result in a left hemiparesis or paralysis.[17]

The "Zone of Language"

The "zone of language" is clustered around the Sylvian Fissure on the lateral surface of the dominant hemisphere and includes portions of the frontal, parietal, and temporal lobes.[5] It extends anteriorly from Broca's area located in the premotor area of the frontal lobe to Wernicke's area located in the temporal-parietal region of the left hemisphere.[5,14] (See Figure 1.)

In general, lesions in the "zone of language" in the left or dominant hemisphere result in aphasia. However, there are many other areas of the brain which contribute to language function. Even the simplest language task is dependent on the extremely complex interaction of the zone of language in the left hemisphere with the reticular activating system, subcortical nuclear structures, subcortical white matter, and areas of the right hemisphere. Thus, the zone of language should not be regarded as the center of language but as a critical component of many overlapping neural networks which come together to produce language.[5]

Aphasia Syndromes

Aphasia has traditionally been classified into different syndromes according to the location of the lesion. According to this classification system, a lesion in a certain area will produce characteristic symptoms and a predictable form of aphasia. It is important to remember that the human brain functions as a whole and that damage to one part of the brain influences much more than just the perceptual or cognitive functions identified for that particular area. Further, there is great variability in the brain from one individual to another, such that two patients with brain lesions in the exact same location may have different deficits.[15]

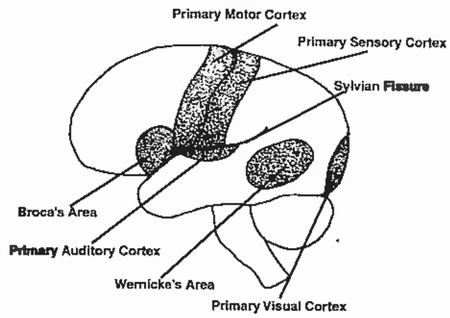

Figure 1.

1. Broca's Aphasia (also called motor aphasia, expressive aphasia, or anterior aphasia) is usually seen following damage to Broca's area which is located in the left posterior inferior frontal lobe. (See Figure 1.) Broca's area, the motor speech area, plays an important role in planning and organizing motor activities of speech.[16] Therefore, comprehension of language is better than speech production or writing for patients with Broca's aphasia. These patients understand written or spoken words but cannot respond in an articulate manner.[1] Writing is usually affected to the same degree as speech.[18] Since Broca's area is located close to the primary motor cortex of the face, hand and arm, a hemiparalysis or hemiparesis will usually accompany Broca's aphasia.[16]
2. Wernicke's Aphasia (also called receptive aphasia, sensory aphasia, or posterior aphasia) results from damage to Wernicke's area, located in the posterior third of the superior temporal gyrus of the left hemisphere.[5] (See Figure 1.) Wernicke's area is the auditory association cortex and is responsible for auditory comprehension.[16] A patient with Wernicke's aphasia is unable to understand spoken, written or tactile speech symbols.[1] Spoken language is fluent and well-articulated, but the words do not come together to make an understandable message. The words are usually inappropriate for the situation and the patient is unaware that their utterances do not make any sense.[9] In addition, damage to Wernicke's area may result in a superior quadrantanopsia.[14]
3. Anomic Aphasia can result from any lesion in or near the zone of language of the dominant hemisphere. Therefore, virtually every aphasic syndrome will contain an anomic component.[5] Focal lesions in the angular gyrus or second temporal gyrus can also produce anomic aphasia.[10] Patients with anomic aphasia have word finding difficulties.[9] Although speech is fluent and grammatically correct, there are unusual pauses due to word retrieval failure. These patients often engage in circumlocution; they describe the missing word without using it.[19] They also will substitute non-specific words such as "thing" in place of the missing word.[16] Anomic aphasia is the most common aphasic syndrome seen after closed head injury.[5]
4. Conduction Aphasia results from a lesion interrupting the articulate fasciculus, the white matter pathway connecting Wernicke's area and Broca's area. These patients are unable to repeat or write what they hear.[16]
5. Global Aphasia is the most severe form of aphasia and is usually caused by damage to the entire perisylvian region of the dominant hemisphere. A patient with global aphasia will show severe impairment in all language abilities. Both speech comprehension and production will be impaired.[14]

Other Areas of the Brain which Contribute to Language

The main function of the frontal lobe is voluntary control of motor movements, including eye movements, of the entire body and is responsible for the planning and execution of complex motor acts.[13] Each frontal lobe controls willed motor movements to the opposite side of the body via the pyramidal system.[5] Damage to Broca's area extending into the surrounding area of the left frontal lobe can result in apraxia of speech. These patients are unable to preplan, initiate and correctly sequence speech movements even though their speech muscles are intact.[3] The frontal lobe also mediates abstract thinking, problem solving and judgment, all of which are important in language.[5] Frontal lobe syndrome can result from damage to both frontal lobes. These patients are apahetic and lack motivation.[20] The hallmark behavior of this syndrome is perseveration where the individual repeatedly gives the same response to any question asked.[21] This is important to keep in mind when testing head trauma patients who may develop this as a sequela to a contre-coup type injury.

The primary auditory cortex is located below the Sylvian Fissure in the temporal lobe. (See Figure 1.) This area is responsible for the perception of auditory stimuli and the discrimination of sounds.[16] As a result, the temporal lobes play an important role in the processing and analysis of auditory stimuli which is necessary for making an appropriate response through language.[13] They are also involved in the visual recognition and identification of people, places and objects and play a role in the localization of objects to self (me-it relationships).[13,22] In addition, the temporal lobes play a key role in overall memory function. Verbal memory deficits are associated with lesions to the left temporal lobe. The memory of the visual attributes of objects is mediated by the right temporal lobe. Patients with damage to the right temporal lobe have problems remembering faces and material that cannot be easily coded verbally.[23]

Each parietal lobe is responsible for the integration and analysis of somesthetic sensations such as pressure and touch coming in from the opposite side of the body.[5] The parietal lobes also play an integral part in the localization of objects in space (me-it relationships) in addition to the relationship of objects to each other (it-it relationships).[13,22] Damage to the left parietal lobe has been shown to have an effect on the expression of ideas through language.[13]

Visual association area 18 of the primary visual cortex is responsible for the differentiation of shape, color and size. Damage to this area results in problems with word and letter recognition.[24] (See Figure 1.)

The thalamus, which is part of the subcortical gray matter, plays an important role in memory and attentional skills. Lesions in the left thalamus have frequently been shown to result in problems with verbal memory.[5]

The limbic system is a complex network of cortical and subcortical structures that mediate emotion and, therefore, has an important effect on feelings, the desire to produce language, and the emotional coloring of thoughts and spoken language.[5]

Communicating with an Aphasic Patient

To the doctor, aphasia is an acquired impairment of language abilities. However, to patients, it signifies a dramatic change in their personal life and relationships. They now have a communication handicap which may also be accompanied with a physical handicap. The very core of human existence is the need for socialization and communication. When people lose language function, they lose part of themselves. Their ability to function as fully mature, self-reliant, self-actualized adults is reduced and equilibrium is disrupted.[18] As a result, people with aphasia may experience a severe psychological reaction to their sudden language loss.[3] In addition, they may exhibit certain emotional neuropsychiatric behaviors depending on the site of cerebral damage.[3,25] In general, damage to the right hemisphere has been associated with indifferent, euphoric states; where damage to the left hemisphere tends to result in depression.[25]

It's important to understand that a person with a communication impairment does not necessarily have a problem with comprehension. Aphasia, by itself, does not affect intelligence or cognitive ability.[3] The clinician needs to carefully assess the patient's communication abilities as well as physical and mental abilities before selecting a method of communication since patients with aphasia will have varying degrees of language deficits. When examining a patient with Wernicke's aphasia, the clinician must rely on objective tests as this patient will not be able to understand the test instructions. A patient with Broca's aphasia will understand instructions, but will not be able to respond verbally; therefore, different methods of communication need to be employed when examining this patient.[1] Also, patients will have varying degrees of anomia. Flexibility is the key when examining the aphasic patient because each patient is unique with his/her own individual characteristics and deficits.

It is important to face the aphasic patient at eye level when speaking. Eye contact promotes attention and will help the aphasic patient take advantage of non-verbal cues. It will also convey a feeling of genuine interest on the part of the examiner. Speak slowly and clearly but avoid speaking in a child-like, condescending manner. Avoid negative facial expressions. Pause between ideas and check the patient's comprehension before proceeding. Also, provide the patient with appropriate natural feedback, acknowledging the message even if it is linguistically incorrect. For example: "I understand. You mean ______?" or "I'm not quite sure I understand. Did you mean ______?" Encourage the patient to express himself/herself freely without fear of embarrassment. Maintain a positive attitude through the exam, repeatedly emphasizing the patient's accomplishments. The clinician must also remain sensitive to the patient's mood and level of frustration as these factors will not only influence the validity of the test results but will also influence the interdisciplinary treatment plan for the patient.

Primary Care Examination of an Aphasic Patient

A comprehensive examination of an aphasic patient, as well as any brain-injured patient, will likely require several hours and therefore is best done over several sessions, each one lasting no more than one hour.[21] It may also be necessary to take short rest breaks during each session to decrease fatigue and loss of interest.[21,24] The examination room should be cheerful, pleasant, colorful, and brightly lit to create a relaxed atmosphere and help minimize apprehension towards the evaluation.[24] A well-organized room equipped with hand-held instruments is required so that the exam flows with minimal interruptions.[26]

The clinician should obtain the patient's complete medical records before the initial visit. These records should include information on the cause of the aphasia, location of the lesion, time of onset, and the extent of brain damage. The clinician must be aware of any major illnesses the patient has, medications he/she is taking, and the side effects of these medications, as some medications can have an effect on language function. For example, some drugs used to treat hypertension may cause depression which can influence language function and the patient's emotional status. Contact with a reliable family member prior to the exam can also provide very helpful information as many aphasic patients are unable to provide detailed information themselves. A reliable family member may be able to provide information regarding the patient's emotional status, ability to conduct activities for daily living, degree of functional independence, marital and family relationships, personality, educational history, physical status, as well as occupational status before and after the brain damage. It is helpful to obtain as much information as possible regarding the patient's intelligence before the onset of the aphasia as well as any history of developmental learning disabilities. A close family member may also be helpful in providing the practitioner with previously established methods of communication with the patient.[27]

A. Case History

A thorough case history is especially vital with these patients. During the case history the clinician should evaluate the communication skills of the patient in order to choose a method of communication that seems most suitable.

The following is a list of the various methods of communication which may be employed during the case history of a patient with aphasia:

1. The clinician can restrict the case history to yes/no questions and set up a physical code signal for the yes/no responses such as:
   a. Blinking (one blink means yes/two blinks no)
   b. Fingertapping (one tap means yes/two taps no)
   c. Nodding head (one nod means yes/two nods no)
2. A pencil and pad system can be employed where the patient gives written responses to the clinician's questions. However, since writing may also be affected, this may not be an option.
3. A communication board which contains an array of pictures, letters, words or phrases on a durable surface can be used. The clinician can make up a board containing the letters of the alphabet, numbers and the words "yes" and "no." To communicate, the patient points to the board.
4. Portable electronic devices are available in which the patient types the response onto a keyboard and the message is then displayed on a monitor, printed on paper, or translated into speech-like output. These range in cost from $100 to several thousand dollars. A simple, portable system in which extensive training is not needed should be selected.

B. Gross Perceptual Testing

The Piaget Test of Left Right Awareness is a simple test which should be incorporated in the primary care evaluation of any head trauma patient.[1] This test evaluates the ability of the patient to differentiate right from left on self (laterality) and on the examiner, and the ability to project these concepts out in space (directionality).[28] Certain visual acuity tests require adequate laterality and directionality concepts; therefore, this test should be done prior to assessing visual acuity.

C. Visual Acuity

The clinician should use the most efficient, accurate and reliable method to assess visual acuity which is consistent with the patient's communication and motor abilities. If the patient is unable to respond to one test, discontinue, and try another procedure. The clinician needs to find the test procedure that will result in the patient's highest level assessment of visual acuity. Letter recognition acuity is preferred over picture targets. Also, multiple targets with contour interaction are preferred over single targets.[24]

The following tests may be used to assess visual acuity:

1. Snellen Acuity Chart. The clinician may use the Snellen chart to assess visual acuity in conjunction with a communication board. The patient points to the letters on the board corresponding to the letters seen on the Snellen chart. The clinician can also set up a multiple choice system where the patient is given four or five choices and responds a certain way, such as holding up a finger, nodding head or blinking, when the clinician says the letter seen on the chart. Many aphasic patients are able to recognize the letter seen on the chart; however, they will have difficulty naming the letter on their own. For these patients, the clinician can limit the procedure to two choices and the patient responds a certain way to the letter seen on the chart. For example: "Is this letter an 'E' or a 'V'?"
2. Tumbling E Test. Have the patient point in the direction that the "E" is pointing. The clinician can also use a key card and the patient points to the "E" on a card. Keep in mind that this test may be difficult for patients with laterality and/or directionality problems. For these patients, the clinician can try limiting the responses to up, down or sideways, since the letters pointing side to side will be more difficult compared to the letters pointing up and down.[29]
3. HOTV Subtest of the STYCAR Test. This test consists of rows of the letters "H," "O," "T," "V" on a chart presented at 10 feet and the patient points to the letter seen on a key card. The letters HOTV were chosen as they are symmetrical around the vertical axis which helps to avoid left/right confusion.[29] This test is also available at near.
4. Lea Symbols Test. This test consists of lines of four symbols (house, apple, square, circle), each symbol being equally sensitive to blur and equally difficult to distinguish. The patient points to the form seen on the response key. This test can also be administered as a two-choice procedure for patients with naming difficulties. For example, "Is this a house or an apple?" It can be administered at both distance (10 feet) and near (40 cm). An advantage of this test is that all the symbols are perceived as circles when they are no longer distinguishable, thereby avoiding feelings of failure when the patient has reached threshold acuity.[24]
5. Broken Wheel Visual Acuity Test. The patient is presented with two cards containing a picture of a car at 10 feet. The patient points to the card which features a car with broken wheels. The car with the broken wheels utilizes Landolt C targets for the wheels instead of circles.[29]
6. Optokinetic Nystagmus (OKN) Test. This test can give a gross indication that the pathway from the retina to the occipital cortex is intact provided the patient adequately fixates on the drum.[12]
7. Visual-Evoked Potential (VEP) Test. This is an electrodiagnostic test which measures responses at the occipital cortex to visual stimulation of the central retinal cones. It is the only clinical test available which provides an objective measure of visual acuity and therefore can be invaluable when testing a nonresponsive patient.[30]

D. Oculomotor Skills

It is very important to assess oculomotor skills in this population. The frontal eye fields, together with the superior colliculi and the parietal lobe, control voluntary eye movements. Voluntary saccades can be tested objectively by instructing the patient to successfully fixate each of two separated targets.[31] Voluntary pursuits can be tested objectively by having the patient follow a transilluminator and assessing fixation by watching the Hirshberg reflex.[26] Both versions and ductions in all cardinal positions of gaze should be assessed for quality and accuracy of movement, commitancy and restrictions.[13] The clinician can also instruct the patient to report diplopia by raising a finger, blinking or nodding the head during the binocular phase of testing. The clinician must also observe the presence of nystagmus and try to isolate a null point, the position where the nystagmus is at a minimum.[1]

E. Keratometry

Keratometry should be done when feasible to determine corneal astigmatism. This may be particularly helpful in cases where refraction is difficult.

F. Refractive Status Assessment

The following techniques may be used to assess the patient's refractive status:

1. The distance retinoscopic finding is placed in the phoropter and the patient is instructed to hold up one finger if choice one is clearer and hold up two fingers if choice two is clearer as lenses are appropriately introduced. The patient could also tap once for choice one and tap twice for choice two. A trial frame refraction may be advisable if the patient is not comfortable in the phoropter.
2. An over-refraction over the patient's current spectacles using loose lenses can be done to assist the clinician in evaluating the patient's current refractive status. The patient is instructed to hold up one finger if the target is clearer with spectacles alone and two fingers if the target is clearer with the introduced lens. Start by introducing large lens changes and reduce until the just noticeable difference lens is established.
3. Cycloplegic refraction can be done to give an objective measure of the patient's refractive status in an unreliable patient.
4. Mohindra (Near Dynamic) Retinoscopy. Cover one eye and ask the patient to fixate on retinoscope light at a working distance of 50 cm in a totally darkened room. Neutralize the principal meridians in each eye and add -1.25 to each meridian to obtain the net finding.[24]

G. Binocular and Accommodative Status

Distance and near cover testing and nearpoint of convergence (NPC) can all be assessed objectively on an aphasic patient by using a transilluminator and utilizing the Hirshberg reflex.[26] To assess NPC subjectively, the clinician can instruct the patient to hold up two fingers when diplopia occurs and hold up one finger when fusion is regained.

To assess phorias in the phoropter, the patient is instructed to either tap or raise a finger when the appropriate horizontal or vertical alignment occurs. To assess BI and BO ranges in the phoropter, instruct the patient to raise two fingers for diplopia and one finger for fusion. The horizontal phoria can also be assessed in free space by using a vertical prism over one eye and a transilluminator. The clinician instructs the patient to point to the two images and then adds loose horizontal prism until the patient points to two images aligned one above the other. This technique can also be done with red/green glasses and a transilluminator. BI and BO ranges can also be evaluated in free space by using loose prism bars over the trial frame subjective refraction lenses or the patient's current spectacles.

The amplitude of accommodation can be tested using the minus lens technique in the phoropter by asking the patient to raise one finger or tap when the first sustained blur point is reached. Monocular estimation method (MEM) is an objective test which can be utilized to assess the patient's lag of accommodation.[24] The relationship between the negative relative accommodation and positive relative accommodation (NRA/PRA) can also be tested by asking the patient to raise a finger or tap when the first sustained blur point is reached.

H. Visual Field Testing

Visual field deficits are a very common sequela to both CVA and traumatic brain injury and therefore needs to be assessed in the evaluation of an aphasic patient.[22] The most important way to test visual fields in this population is by confrontation method since the clinician is determining the presence of hemianopsias and quadrantanopsias as opposed to smaller scotomas. Confrontation testing can be done by asking the patient to raise one finger, nod head, or blink as soon as the target is seen. The clinician should also carefully observe the patient for visual field integrity. Changing head position when asked to look at an object on the side, constantly bumping into objects on one side, or drifting toward one side may all be indications of a visual field loss. Automated visual field testing or Goldman perimetry should be attempted. However, patients with motor planning deficits and delayed motor responses will have difficulty with these tests.[32]

I. Ocular Health Assessment

All ocular health testing including pupils, slit lamp examination, tonometry, dilated fundus exam, ophthalmoscopy and gonioscopy, if applicable, can be done objectively. If necessary, hand-held instruments should be used. It is important to assess the patient's blink rate and tear break up time as decreased blink rate may result after head trauma.[1]

Conclusion

Aphasia is a very common impairment affecting language ability following cerebral injury. The primary care optometrist can play a key role in improving the quality of life, as well as significantly impact the rehabilitative process of these patients. The primary care optometrist needs to be able to properly assess the patient's level of communication and administer a high-yield test sequence to fully assess the visual system. Understanding the physical as well as emotional effects of this acquired communication deficit can greatly enhance the optometric examination of these patients.

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tive opposition ophthalmology presented for the DPA and TPA battles, we weren't threatening their surgical raison d'être. Although optometric laser use is currently granted in two states, it is probable that ophthalmological opposition will be of a far greater magnitude in this arena than was evident for DPAs and TPAs. Do we have, and are we willing to expend the human and fiscal resources that this battle will require?

An optometric strength in the current climate of health care politics and economics is that we hold ourselves to be primary care providers of eye care. Is it possible that active optometric participation into what is apparently surgery can compromise our primary care status? Is this a risk worth taking? Further, an often heard complaint of health care providers is that in this era of managed care, the bosses are corporate and bean counter types. The industry of eye laser surgery is dominated perhaps even more by these types than the managed care industry. Do we wish to form still more alliances with these individuals?

There are ethical issues to be considered. Presently a number of optometrists hold high positions in companies that will perform PRK, and other optometrists are being recruited to not only become active referral sources to these companies, but are also encouraged to invest in them.[1] Do these relationships constitute, or can they be perceived to be a conflict of interest?

And finally, have we adequately considered the position of optometric education if we win the battle? This branch is still dealing with the demands placed on it as the states granted first DPA and then TPA privileges to the profession. Curricula that are said to be of a four-year duration are really longer by virtue of the requirement of practically every school and college of optometry for their students to complete summer clinical rotations. The envelope of optometric education has been stretched and is it possible that the instruction required for the use of lasers will provide the breaking point?

All of these questions are not easy to answer. They are certainly worthy of a wider forum than I perceive to have taken place. While the ability to use DPAs and TPAs have gradually changed the face of optometry, the granting of the use of lasers will undoubtedly change the body of the profession. Is this what we really want and is it in the best interest of the public?

The key issue is whether the impending battle to use lasers constitutes an overkill, or rather a requirement for optometry's future maintenance and prosperity. The model we can use is evident in "Fiddler:" for as Tevye, perhaps the prototype long range and strategic planner in the modern sense, often stated when coming to a difficult decision..."On the other hand...."

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