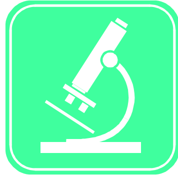


Right Brain Rehab

TBI Challenge! (Vol. 4, No. 1, 2000)

by Richard C. Senelick MD

Introduction

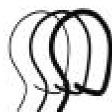
Most physicians, nurses and therapists clearly can state that the left side of the brain is dominant for language and also controls the movement on the right side of the body. When asked to list the functions of the right side of the brain, however, most professionals get no further than "controlling the left side of the body." In reality, the right side of the brain is not "silent," but rather possesses specific functions necessary for human behavior. The medical professional must be aware of these functions because right hemisphere dysfunction is seen regularly in persons with strokes and brain injuries.

Brain Controls

The concept that parts of the brain have different functions was first proposed in 100 AD when specific functions were ascribed to the ventricular system, those spaces within the brain that contain cerebrospinal fluid. Philosophers and "scientists" thought that humors or animal spirits circulated within the ventricular system of the brain and were responsible for different types of behavior. It was not until the 17th and 18th centuries that functional localization moved into the substance of the brain and resulted in the designation of the left side of the brain as the major hemisphere that controlled speech and most other aspects of cognition. It was not until after World War II, however, that people began to recognize the functional properties of the right hemisphere and that the right side of the brain seemed to govern attention, sophisticated visuospatial skills and a significant part of human emotions.

The two hemispheres of the brain are not mirror images of each other and differ in both their functions and structural properties. Anatomical studies and, more recently, computed axial tomographic (CT) analysis, have demonstrated significant neuroanatomical asymmetries that are most marked in the temporal-parietal region of the brain. It is not clear, however, whether these anatomical asymmetries correlate directly with functional differences. Of interest is that these differences are more marked in man than in lower animals, suggesting that further anatomical specialization occurs with evolution.

The functional organization of the right hemisphere is much less specific than that of the left. Discrete lesions in the left hemisphere result in highly specific types of language disorders. A stroke involving the frontal speech area results in a non-fluent aphasia with few words, whereas a lesion more posterior in the parietal region results in a Wernicke's or fluent aphasia with jargon or nonsensical language. Disorders such as neglect, anosoagnosia and extinction do not



necessarily occur following injury to a specific area of the right hemisphere, but may occur after injury to one of multiple sites. It is best to think of the right side of the brain as a "network" of interconnected areas, each interdependent upon each other—complex brain functions being controlled through different areas that are connected by this network.

Both sides of the brain appear to participate equally in the control of primary motor and sensory functions, but the control of more complex functions appear quite asymmetrical. Both sides of the brain participate in most intellectual activities, but make separate contributions to the final output, each contributing their unique capacities and functions to work in concert with the other hemisphere.

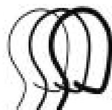
One Half of Your World

The failure to pay attention to stimuli in the left or right side of a person's world is called hemispatial or unilateral neglect and is a disorder of attention. Unilateral neglect is much more common following right brain lesions, generally involving neglect of the left side of one's world.

There are two broad categories of attention, general arousal or alertness (i.e., the ability to awaken in the morning) and selective attention (i.e., the ability to sit in a classroom and focus on what is being taught). General arousal or attention can be thought of having two extremes, wakefulness or sleep and coma. Between these two extremes are many variations reflecting the different degrees of attention. Selective attention allows us to pay particular attention to a single event or stimulus. During the process of selective attention, some information is perceived consciously whereas other information may be analyzed subconsciously or totally filtered out. For example, many people wonder why children can study with the television on. Divided attention allows them to attend to a task while something else also is stimulating the brain.

Neglect is the failure to attend to a new stimulus coming from one side, usually the left. The stimulus may be auditory, visual or tactile. In unilateral spatial neglect, the person behaves as if one-half of his/her world has ceased to exist (i.e., failing to copy one side of a figure, dressing or bathing only one half of his/her body, eating only the right side of his/her plate, failing to read one-half of a page or word). Extinction is the neglect of one of two stimuli presented simultaneously. For example, when touching both arms simultaneously, only the right-sided touch is perceived.

The clinical picture of neglect can vary significantly. Mild cases may demonstrate only extinction with neglect of simultaneous stimuli, whereas more severe cases may find the person with his/her eyes and head deviated to the right, totally ignoring anyone or anything within his/her left hemispace. If approached on the left side, they may fail to respond or actually look for the person on the right side of the room. Most persons fall somewhere in between (i.e., the person who only eats the food off the right side of the plate, leaving the left untouched or the person who may clean or shave only one side of his face). Individuals frequently may get lost



because of their failure to take advantage of left-sided visual cues or they persistently may run their wheelchairs into obstacles in the left side of their world. If a person is given individual words to read, he/she may neglect the left side and read the word long-shot as "shot" or football as "ball."

Assessment Tools

Assessing the person with hemispatial neglect may require more specific testing than routine observation, but these tests usually can be done simply at the bedside or at a table:

- Ask the person to draw the face of a clock, including the numbers or a daisy with its petals. The numbers or petals on the left side may be omitted.
- Draw a straight horizontal line and ask the person to bisect it in the middle.
- Cancellation tests require the individual to circle each letter "A" he/she can find on a sheet of paper. Individuals with right hemisphere damage do not search to the left, omitting those letters to the left side of the midline.
- Sensory neglect is tested by bilateral simultaneous tactile stimulation. To test auditory neglect, the examiner stands behind the person and snaps fingers on the person's left and right side, first on a single side and then simultaneously.

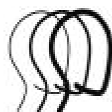
Treating Neglect

The treatment of neglect can be very frustrating. Neglect significantly can affect the prognosis for overall recovery in the acute phase of rehabilitation since it is difficult to have an individual work on disabilities in his/her left arm and leg when he/she may not recognize those extremities as his/her own nor attend properly to that side. The good news is that the vast majority experience complete recovery within six months. I have had patients who seem to "blossom" after they returned home from the rehabilitation hospital and were attended by a home health therapist. Although it is not known if the right hemisphere slowly improves or whether neural components in the left hemisphere are involved in the recovery, the clearing of neglect, significant functional improvement and spontaneous recovery are a wonderful thing to take advantage of.

Denial of Illness

Literally, agnosia is defined as a failure to know or recognize. More specifically it is the inability to derive meaning from sensory information in the absence of dementia or sensory disturbances. The person with agnosia may have a normal visual apparatus and see without difficulty, but be unable to identify or comprehend that which he/she sees (i.e., visual agnosia).

Babinski, a famous Russian neurologist, coined the term anosagnosia in 1914 and used to it to refer to "denial of illness" where the person is unaware that there is anything wrong with them.



In anosagnosia after paralysis, he/she may deny that there is anything wrong with a totally paralyzed left arm or leg. At other times, the individual may admit to being sick but deny hemiplegia and attribute the paralysis to some other condition such as sleeping on his/her arm or leg. Occasionally, the person will attribute ownership of the limb to someone else (i.e., somatophrenia) such that if you show the person his/her left arm and ask him/her who it belongs to, he/she will respond either, "to you" or " I don't know."

Anosagnosia usually is associated with both a marked sensory disturbance and paralysis, and more commonly is seen in the acute period following a stroke rather than in chronic paralysis. Neither the sensory loss, nor confusion or disorientation adequately explain the phenomena of anosagnosia, although a number of theories have been proposed:

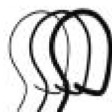
1. Anosagnosia is a form of neglect or inattention.
2. Anosagnosia is the mechanism for recognition of body deficits residing within the right side of the brain.
3. Anosagnosia is a true agnosia and disconnection syndrome in which information regarding the deficit in the right hemisphere cannot be transferred to the left hemisphere and be "verbally realized."

Recognizing Faces

Prosopagnosia is a peculiar disorder in which the person may be unable to recognize faces and in the most severe form may be unable to recognize his/her own face in the mirror. When asked to look at pictures of family members or familiar people, he/she may be unable to recognize them. If family members walk into the room, the person may be unable to recognize them until they speak, supplying the necessary auditory cues to allow proper identification. The complex mechanism for facial recognition is not understood well, but pathologic studies demonstrate lesions bilaterally in the occipto-temporal regions. Although the right hemisphere appears to provide a major component in facial recognition, bilateral lesions are necessary for the manifestations of prosopagnosia.

Constructional Apraxia

Karl Kleist introduced the term constructional apraxia in the 1920s to designate a specific defect in spatial organization and constructional activity. It describes an inability to copy figures or reproduce models or blocks. Kleist demonstrated an inability to do on command that which an individual may be able to do spontaneously. With apraxia, the examiner is unable to find a motor, sensory or visual disturbance to explain the deficits and the deficit is truly a higher visuoconstructive abnormality of spatial analysis. Defects in these tasks are seen following damage to the right parietal region.



Dressing Apraxia

This appears to be a defect in visuomotor orientation or "body-garment" orientation, with the person failing to orient the garment to his/her body and an inability to don a shirt or coat properly. This abnormality most commonly is linked with right parietal lobe damage.

The Texture of Speech

Speech is composed of two major components: (1) a linguistic or propositional component which represents the actual words and syntactic relationship between words, sentences and paragraphs; and (2) prosody, which represents the affective coloring of our speech, its melody, pauses, intonation, accents and cadence. Prosody is the component of speech that makes a statement a question or an exclamation by adding emphasis. Aprosody is the loss of this affective component of speech which can be seen in individuals with anterior lesions of the right hemisphere. The person's speech may not only lack the ability to convey an emotional component, but he/she may be unable to comprehend prosodic intonations of others' speech or have difficulty interpreting the emotional content of facial expressions.

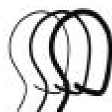
Gestures also add meaning to our speech and are a form of nonverbal communication that embellishes and colors our speech. Individuals with right frontal lesions may lose their ability to use gestures, but will retain the ability to comprehend gestures. If the lesion is in the temporal region, he/she may lose the ability to comprehend gestures, but be able to use them spontaneously.

Bedside testing for prosody can be accomplished with a few simple procedures:

1. Spontaneous affective prosody and gesturing are tested by asking questions like "How do you feel about your illness?" Then observe the individual's response.
2. Ask the person to repeat a sentence with the same affective tone as the examiner (i.e., "I'm going to the therapy gym"). Repeat the sentence in a happy, sad and angry tone, observing the individual's ability to comprehend and produce an affective component to his/her speech.
3. Stand behind the person and make statements with different affective components, asking him/her about his/her emotional content.
4. Use gestures with your speech and ask the individual for the meaning, being careful not to use pantomime.

Neuropsychiatric Disturbances

Despite their inability to express or interpret the affective components of speech, persons with right hemisphere dysfunction still may experience the emotions of joy, sadness or depression. However, these emotions may manifest at their extremes with outbursts of emotion. Right hemisphere strokes may present as acute confusional states or be mistaken for other acute



encephalopathies. Many individuals with damage to their right hemispheres have components of mania with hyperactivity, irritability, flight of ideas, diminished sleep and pressured speech. Fortunately, these symptoms usually diminish during the acute phase of rehabilitation and do not require pharmacologic intervention.

Think Right

No one gains a comfortable knowledge of these difficult concepts with a single reading. There is more here than "pop psychology" and getting in touch with the artistic side of our brain. So, when you see a person with weakness on the left side of his/her body, think and look beyond the obvious. You not only will be fascinated by what you find, but you can help the person move forward through the rehabilitation process.

Dr. Senelick is a neurologist who specializes in neurorehabilitation. He is the medical director of HealthSouth Rehabilitation Institute of San Antonio (RIOSA) where he also serves as director of the Brain Injury Program. He is also the author of Living with Brain Injury: A Guide for Families.