Unilateral Spatial Neglect

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Abstract

Unilateral spatial neglect (USN) refers to the condition that occurs when a patient is unable to perceive one side of her world. Typically, USN is a result of a right hemisphere stroke where a patient loses their concept of left. In fact, 50% of patients following a right hemisphere stroke develop USN. USN can be both temporary and chronic, lasting from days after the trauma to a lifetime. The three major types of symptoms characteristic of USN are sensory neglect, motor neglect, and memory and representational deficits. Although motor neglect is the most recognizable symptom, sensory neglect is typically used in making a diagnosis of USN, using tests like the cancellation task. The biological mechanism of USN implicates damage to the angular gyrus of the parietal lobe. USN is a difficult diagnosis, yet with occupational therapy and a positive attitude, patients are able to modify their lives to the disorder.

In her 2011 novel, neuroscientist Lisa Genova describes the lifestyle of a woman with hemispatial neglect, which she terms "left neglect" (Genova, 2011). Prior to a traumatic car crash, this woman is a financial executive with two young children. After the onset of neglect, she is unable to function on a daily basis and cannot perceive the left of her world. Oliver Sacks also gives a chilling recollection of a patient encounter of his, a woman who is unable to perceive her left visual field. She has no damage to her visual organs, yet "she has totally lost the idea of 'left,' with regard to both the world and her own body" (Sacks, 1985, p. 77). This patient was diagnosed with hemispatial neglect following a stroke.

Hemispatial neglect afflicts approximately 50% of patients following a right hemisphere stroke and can be both short-term and long lasting, with 10% of patients still affected after six months. (Barrett, 2010) The symptoms of hemispatial neglect are psychologically, as well as physically, debilitating. Sacks depicts this in his presentation of "Mrs. S," who intellectually is aware of her disability, yet cannot completely understand the nature of her problem, as she lacks an understanding of the concept "left". Although fairly common, cases of hemispatial neglect are not well understood and just recently research has been done on the biological nature of the ailment.

Hemispatial neglect, also termed unilateral spatial neglect (or USN), is representative of numerous symptoms pertaining to the neglect of "stimuli located contralaterally to a focal hemispheric lesion, even in the absence of primary sensory or motor deficits" (Verdon *et al*., 2010). The most common form of hemispatial neglect is an ignorance of the left side. Three categories of symptoms have been identified, namely memory and representational deficits, motor neglect, and sensory neglect (Swan, 2001, p. 1572). These three categories provide great insight into the potential mechanisms for the disorder, as they characterize three distinct losses by the disease.

Representational and memory deficits can be most notably seen when asking patients to recall a scene from memory. As mentioned by L. Swan, if patients are asked to "describe, from memory, a square in Milan" (Swan, 2001, p. 1572), they would accurately portray the right side of the square, but pay no attention to the left side. If then asked to describe the square positioned from the opposite orientation, they would give the new right (the old left) of the square, but pay no attention to the new left (old right) side. Fascinatingly, the entire square is encoded in the patients' memory. Patients are able to describe each half of the square at different times, yet in a single instance, they can only perceive one half of the square in their memory.

More obvious to the observer of a patient with USN, however, is the associated motor neglect. A hemispatial neglect sufferer may exhibit a relaxed position with the head turned toward the right side, may orient to the right when approached from the left, or may navigate a wheelchair toward the right side (Barrett, 2010). What must be recognized, however, is that "motor neglect is not a deficit of the motor pathway, but rather a failure or decreased ability to move in the contralesional space" (Swan, 2001, p. 1573). Watson showed that monkeys with induced USN showed no weakness in the contralesional limb, yet when stimulated by a sensory stimulus, the neglected limb demonstrated far less motor response than the unneglected limb (Watson, Miller, & Heilman, 1978). As patients find themselves unable to move to the left, getting around independently becomes difficult.

The third deficit characterized in hemispatial neglect is that of sensory neglect. Sensory neglect refers to patients' complete neglect of their left visual and spatial field. This is the most characteristic symptom of the disorder as observed by an outsider because merely standing on the left side of the patient will render one completely out of the patient's "world." A patient with hemispatial neglect may experience sensory neglect to the extent of asomatognosia, or notion that the neglected limb/hemisphere of the body does not belong to her. For instance, "when approached…from their left they may fail to acknowledge them or…they may orient themselves to the right and reply with their gaze directed away from the person they are addressing" (Parton, Malhotra, & Husain, 2004, p. 13). An absolute disregard for the left is frustrating for those around the patient, but also for the patient herself since she is equipped with the intellectual knowledge of someone in the room, but unable to verify such information with experiential "fact." In fact, many of those affected by hemispatial neglect, exhibit a symptom called "anosognosia" (Parton *et al*., 2004, p. 15), in which the patient is completely unaware of any neurological ailment.

A notable example of sensory neglect can be seen in the cancellation task, which is the most widely used diagnostic tool for hemispatial neglect. In the cancellation task, patients are shown a visual screen with multiple items on it and are instructed to mark out the target items (i.e. "C" amidst a sea of circles). Patients with hemispatial neglect usually cancel only the target items in the right visual field, as if those in the left visual field do not exist. Additionally, patients who are asked to draw a clock will draw just the right side (numbers 12-6) and feel as if they have drawn a complete clock. Thus, sensory neglect is used in diagnosing USN as it is the most easily measured symptom.

As aforementioned, patients exhibit numerous symptoms of hemispatial neglect for short or long periods of time; yet the biological basis for said symptoms must also be discussed. Specifically, damage to the parietal lobe following a right hemisphere stroke (or some other form of trauma) has been implicated in the biological mechanism of USN (Verdon *et al*., 2010, p. 881). There are many anatomical

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structures correlated with USN, but "the critical brain region involved in every case of neglect…was found to be the angular gyrus of the parietal lobe" (Parton *et al*., 2004, p. 15), which is consistent with the notion that the parietal lobe is the main brain region involved in neglect symptoms. Many patients also have damage to the mid-superior temporal gyrus (STG), as well as subcortical lesions (Parton *et al*., 2004, p. 15). Similarly, Verdon *et al*. showed in their 2010 paper that hemispatial neglect is a "disorder affecting a large-scale right hemisphere network, with distinct components in prefrontal, parietal, [and] temporal" (Verdon *et al*., 2010, p. 892) areas of the brain. However, neglect can arise following a myriad of cortical and subcortical issues, which yield to the numerous potential mechanisms underlying the disorder as well as the various symptoms that may be associated with hemispatial neglect.

As of yet, the most used USN treatment is occupational therapy, the main goal being to adapt to the neglect symptoms (Parton *et al*., 2004, p. 16-18). Unfortunately, hemispatial neglect, when chronic, is a lifestyle-changing diagnosis. However, it is possible to live a fulfilling life with USN. Lisa Genova's character ultimately begins to snowboard using handicapped equipment, as she loved skiing before her accident. She chooses to change career paths and helps other disabled people ski and snowboard (Genova, 2011). As evidenced by Lisa Genova's novel, although hemispatial neglect is a devastating diagnosis, embracing the modifications necessary to live with the disorder can yield a fulfilling life.

References

1 Genova, L. (2011). *Left Neglected*. New York, NY: Simon & Schuster.

2 Barrett, A. (2010, Dec. 14). In *Spatial Neglect*. Retrieved Sept. 15, 2011, from http://emedicine.medscape.com/article/1136474-overview

3. Parton, A., Malhotra, P., & Husain, M. (2004). Hemispatial Neglect. *Journal of Neurology, Neurosurgery, and Psychiatry*, *75*, 13-21.

4 Sacks, O. (1985). *The Man Who Mistook His Wife for a Hat and Other Clinical Tales*. New York, NY: Simon & Schuster.

5. Swan, L. (2001). Unilateral Spatial Neglect. *Physical Therapy*, *81*, 1572-1580.

6 Verdon, V., Schwartz, S., Lovblad, K. O., Hauert, C. A., & Vuileumier, P. (2010). Neuroanatomy of hemispatial neglect and its functional componenets: a study using voxel-based lesion-symptom mapping. *Brain*, *133*, 880-894.

7. Watson, R. T., Miller, B. D., & Heilman, K. M. (1978). Nonsensory neglect. *Annals of Neurology*, *3*, 505-508.