Hemispatial Neglect, Balint's Syndrome and Attention☆

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Glossary

Anosognosia A neurological disorder, usually caused by brain injury, characterized by the sufferers denying they have an impairment.
Balint's syndrome A neurological disorder characterized by simultanagnosia and optic ataxia. Typically caused by bilateral damage to the posterior parietal cortex.
Extinction A neurological disorder where the ability to attend to stimuli in a particular region of the visual field is impaired by the presence of stimuli outside that region.
Optic ataxia The inability to guide the hand toward an object using visual information that cannot be explained by motor or sensory deficits.
Simultanagnosia The inability to perceive more than one object at a time.
Somatoparaphrenia The belief that part of one's body belongs to another person.

Introduction

Hemispatial neglect, also known as unilateral neglect, hemineglect, neglect syndrome or spatial neglect, is a disabling brain disorder, typically caused by a brain lesion. Patients with neglect have difficulty paying attention to contralesional space and compensate by overly attending to ipsilesional space. It is most commonly caused by damage to the right cerebral cortex. Damage to the left cerebral cortex can also cause neglect but it is less common and typically less severe. Neglect is especially likely to be caused by lesions near the junction of the temporal lobe and the inferior parietal lobule. It can also be caused by lesions in the frontal cortex, in the white matter or in subcortical areas such as the thalamus and basal ganglia.

Neglect may be egocentric or allocentric depending on whether it is orientated relative to the patient or to an object. Although left hemifield and right hemifield neglect are the most common, other forms of egocentric neglect are possible. For example, a patient may ignore the upper visual field in preference to the lower. Egocentric neglect is often orientated relative to the point of fixation. In such cases, the degree of neglect might be influenced by the orientation of the patient's head and trunk. Thus, an object that is contralesional relative the point of fixation but ipsilesional relative to the head and trunk may be less neglected than one that is contralesional in all three coordinate systems. Egocentric neglect may also be orientated relative to a hand or another part of the body. A patient with allocentric neglect may be able to detect objects located anywhere in the visual field but will report only one side of each object. If the currently-viewed object is rotated by 180° the patient will continue to ignore the same part of the object. Thus, a patient with allocentric neglect who typically ignores the left sides of objects will ignore what has become the right side of the rotated object.

Although neglect can be so extreme that the patient fails to notice large objects on the contralesional side, it need not be total. It may manifest itself only as a tendency not to respond to stimuli in the neglected region. If neglect is not total, the addition of stimuli to the ipsilesional side may further decrease the ability to attend to stimuli on the contralesional side, a phenomenon known as extinction. As both extinction and neglect can occur independently of each other, they may be distinct disorders.

Forms of Neglect

Visual neglect is the most common and may result in some or all of the following symptoms: The patient may shave or apply make-up to only one side of his/her face. She may eat from only one side of a plate. When moving in her wheelchair, she

☆*Change History*: October 2015. PDL Howe updated the entire text of the article.

may bump into objects on the neglected side. If asked to bisect a line that crosses the visual midline, she may be biased in the nonneglected direction. When copying a picture, she may have a tendency to copy only the nonneglected side. When presented with an image, she may look mainly (or exclusively) to the nonneglected side. Rapid eye movements (REM) to the nonneglected side may occur in REM sleep. If asked to circle all occurrences of a specific letter, she may concentrate on the occurrences that appear on the nonneglected side, circling them repeatedly to the near, or even total, exclusion of those that appear on the neglected side.

Neglect can occur in other sensory domains such as the auditory, olfactory or somatosensory. If it occurs in the somatosensory domain the patient will ignore a region of her body and may even deny ownership of neglected limbs, sometimes believing that they belong to someone else (somatoparaphrenia). Often the neglected area is also paralyzed. In such cases, neglect may cause the patient to be unaware of or to deny the paralysis (anosognosia). Neglect can also affect motor responses. Although a patient may have no physical impairment, she might have difficulty initiating movement or the movement may be slow.

Although comparatively rare, representational neglect is possible. When asked to visualize a scene, a patient may fail to mention items on the contralesional side. When asked to visualize the same scene but from the opposite direction, the patient may then report the previously ignored items.

Processing of Neglected Stimuli

Neglect is not caused by a disruption of the visual system per se but a disruption of the cortical system that deploys attention. Neglect patients are not blind but fail to consciously perceive stimuli located in the neglected hemifield because they do not attend to them. Some stimuli can be perceived even when they are not attended and so can be readily seen by a neglect patient. For example, if a bright spot of light is presented in complete isolation on a uniform black background most neglect patients will be able to detect it, regardless of where it is located, especially if it is flashed repeatedly.

There is evidence that quite sophisticated processing can occur in the neglected region. For example, if a word is presented on the neglected side, even when it is not consciously seen, it may cause the patient to respond more quickly to similar words presented on the nonneglected side. Similarly, if a patient is simultaneously presented pictures of two different houses and asked which would be better to live in, the patient might reliably choose the house that is not on fire, even though the flames appear only in the neglected hemifield, and thus are not consciously perceived. When asked to explain her choice, she may not be able to do so and will often confabulate. Other studies have asked patients to compare two simultaneously presented pictures and report whether they are the same or different. Patients could do this task even when one or both of the pictures were presented to the neglected hemifield.

Balint's Syndrome

Balint's syndrome is a brain disorder, thought to be related to neglect, first reported by Reszo Balint in 1909. Whereas neglect is caused by unilateral damage, Balint's syndrome is caused by bilateral damage, typically to the posterior parietal cortex. Unlike a neglect patient who is unable to attend to objects in a particular region of the visual field, a patient with Balint's syndrome may be able to attend to an isolated object, regardless of where it is located. The patient may additionally find it difficult to point to the object (optic ataxia) or to perceive more than one object at a time (simultanagnosia). While these patients can often perceive the features in a scene, they have difficulty determining which feature belongs to which object, an issue known as the binding problem. As a result, they have a tendency to conjoin features that belong to different objects and so perceive illusory conjunctions. For example, if the scene contains only red vertical bars and blue horizontal bars, a patient with Balint's syndrome might perceive a blue vertical bar, even after studying the display for several seconds.

Conclusion

Studies of neglect indicate that there is inter-hemispherical competition between the cortical circuits that control the deployment of attention. Damage to the attentional circuits in one hemisphere will allow those in the other hemisphere to dominate, so attention will be directed more often (or even exclusively) to the contralesional visual field. If both hemispheres are damaged, then neither can dominate, so a patient with Balint's syndrome can perceive an isolated object regardless of where it is located. However, due to the damage to her attentional circuits, the patient may be unable to perceive more than one object at a time.

Several studies have shown that an object located in the neglected region can be represented even when not consciously perceived. How this occurs is controversial. A possible explanation is that the attention required for conscious awareness might be different from that required to form object representations and that in neglect only the first type of attention is inhibited.

Further Reading

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