Chapter 17
Right Hemisphere Damage
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The cerebral right hemisphere (RH) plays a critical but often overlooked role in language and communication. Right hemisphere damage (RHD) can result in problems with the expression and comprehension of intent—what a person means, as opposed to what a person says. The "extralinguistic" processes needed to link sentences together in a coherent story, to identify the gist or main idea, and to integrate nonverbal as well as verbal information are essential for effective and efficient communication, and often are impaired after RHD.

Although great strides in our understanding of RHD have occurred since the late 1970s when RH communication abilities began to be studied in depth, there remain large gaps in our understanding about RHD disorders, the neural correlates of the disorders, and, perhaps most significantly, how to treat them. Unlike the left hemisphere, there is no obvious localization of language or communication processes within the right hemisphere. Specific abilities may be the result of processing by large networks instead of relatively restricted areas. There is a glaring need for treatment research to support evidence-based practice for RH cognitive communication deficits. Some treatment research has been conducted for neglect and apraxia, but treatments for language, pragmatic, and cognitive deficits are nearly nonexistent.

There is also a great need for education about RH deficits—for patients, physicians, and families. People who have an RH stroke are less likely to present to an emergency department within the first few hours after stroke onset, and less likely to receive current medical treatments (DiLegge, Fang, Saposnik, & Hachinski, 2005; Foerch, Misselwitz, Sitzer, Berger, Steinmetz, & Neumann-Haefelin, 2005). Communication disorders may be overlooked by physicians and neurologists, resulting in few referrals to speech-language pathologists (SLPs) (Blake, Duffy, Tompkins, & Myers, 2003). The families may not receive any information about potential cognitive and communication changes, and have no explanation for why their loved one is "not the same person" as before the stroke.

* General Characteristics

Estimates suggest that approximately half of a nonselect group of adults with RHD have verbal communication impairments (Joanette & Goulet, 1994), whereas more than 80% percent of adults with RHD admitted to a rehabilitation unit may have some type of cognitive or communication deficit (Blake, Duffy, Myers, & Tompkins, 2002; Côté, Payer, Giroux, & Joanette, 2007). Attention, visuoperception, and learning and memory deficits are most commonly diagnosed by rehabilitation professionals (neurologists, neuropsychologists, occupational therapists, SLPs; Blake et al, 2002). Communication deficits are less commonly diagnosed. There are no obvious patterns of deficits after RHD (e.g., as opposed to identifiable types of aphasia), although deficits in attention and learning/memory tend to co-occur.
One formidable obstacle in diagnosing RHD deficits is that there are no clear boundaries between normal and abnormal behavior for many of the pragmatic and cognitive abilities affected by RHD, given the wide range of what is considered "normal" in the general population. Additionally, efficiency of communication declines in normal aging (Mackenzie, Begg, & Brady, 1997). SLPs do not always agree among themselves about whether communication characteristics are indicative of RHD or normal aging (Lehman Blake, 2006), nor do they always agree with family members about communicative behaviors that are inappropriate (Baron, Goldsmith, & Beatty, 1999). Thus, it is important to discuss a patient's behaviors with the family to determine which ones may be new or abnormal for a given patient, and which ones are consistent with that patient's pre-stroke behavior.

For current purposes, the myriad deficits associated with RHD are divided into three general categories: communication, attention/neglect, and cognition. These categories are for expository purposes only; in a patient with RHD, deficits in one area impact performance in another area, and in some cases they may be difficult to separate.

Communication

Disorders resulting from RHD may not affect the basic language processes (i.e., word- and sentence-level processes), but are manifest primarily in pragmatics, which involve the relationship between language and social contexts, including the intent of the communication exchange (Joanette & Ansaldo, 1999; LaPointe, Murdoch, & Stierwalt, 2010; Myers, 2001).

Figurative/Nonliteral Language

One of the most commonly described RHD deficits is the misinterpretation of nonliteral language. Adults with RHD often do not fully appreciate the abstract meaning of words and phrases, but they are not completely literal. They recognize idioms in implicit tasks that do not require metalinguistic judgments, despite problems in explicitly explaining those same idioms (Tomkins, Boada, & McGarry, 1992). They respond appropriately to indirect requests (e.g., "I can't hear the radio" as a request to turn up the volume) more often in naturalistic situations than when presented without a context, as in experimental conditions (Vanhalle, Lemieux, Joubert, Goulet, Ska, & Joanette, 2000). They also produce both direct and indirect requests in conversation, similar to adults without brain damage, although they may not provide a reason why they are making a specific request, which older adults without brain damage usually do (Brownell & Stringfellow, 1999). Difficulties interpreting nonliteral language may be related to problems with abstract ideas, but also may be related to inefficiencies in selecting one of multiple possible meanings, as described below.

Inferencing

Generation and interpretation of inferences also may be problematic after RHD. Inferencing in adults with RHD is not completely absent, but rather the likelihood of inferencing problems depends on the type of inferences required, whether inference revisions are needed, and the availability of cognitive resources (see Lehman & Tompkins, 2000, for a review). Basic inferences necessary to link two sentences together create little or no problem for adults with RHD. Elaborative inferences, those that add information to a passage but are not necessary for basic understanding (e.g., predictions and character emotions), are thought to require more cognitive resources and are more likely to be impaired.

Sidebar

Careful examination of patients' responses indicates they usually are not completely concrete. For example, when asked to explain the proverb "Don't cry over spilled milk," one patient said, "Don't cry about something spilled or thrown out because you can get something to take its place that may be better." She included literal aspects of the phrase, but also some fragments of an abstract meaning.
after RHD. However, even these more “difficult” inferences can be facilitated by a context that strongly biases toward a specific interpretation or outcome (Blake, 2009).

Problems often occur when multiple interpretations are possible and the comprehender has to select the most appropriate meaning, or when an initial interpretation must be revised. Tompkins, Baumgaertner, Lehman, and Fassbinder (2000), Tompkins, Fassbinder, Lehman Blake, Baumgaertner, and Jayaram (2004), and Tompkins, Lehman-Blake, Baumgaertner, and Fassbinder (2001) proposed a suppression-deficit hypothesis, which suggests that individuals with RHD can generate several possible interpretations, but are inefficient at suppressing or inhibiting the interpretations that are less likely for a given context. These difficulties may underlie RHD problems with understanding humor (Brownell, Michel, Powelson, & Gardner, 1983), attributing emotions to a story character that are different from the comprehender’s emotions (Weylman, Brownell, Roman, & Gardner, 1989), or interpreting literally false statements such as white lies or sarcasm (Stemmer et al, 1994; Winner et al, 1998).

**Sidebar:**

Workbooks for RHD often include tasks requiring clients to generate multiple possible meanings of idioms, metaphors, or ambiguous words. The majority of the research, however, suggests that selecting an appropriate meaning is the problem (not generating meanings). Emphasizing the use of context to determine the most likely meaning is not only more in line with the research results, but also makes more sense as a general skill that the client can use outside of therapy.

Imagine you hear someone say, “Great weather we’re having today.” To determine the intent, whether the speaker is happy about the weather or being sarcastic, you will take into consideration the prosody used, the speaker’s facial expression, the actual weather, your knowledge of any plans for that day, and perhaps your knowledge of the speaker—whether she tends to be sarcastic or not. Focusing not only on the potential meanings, but the most likely meaning, given all of the available cues, may be more beneficial and more functional. Emphasis on contextual cues can go beyond nonliteral language. If someone with RHD has receptive apraxia, and cannot use the prosodic cues, it may be beneficial to increase her awareness of the other contextual and situational cues that can illuminate the speaker’s intent.
are a result of inefficient processing, not an inability to process the information. Slow or inefficient processes are hard to detect with off-line tasks such as question/answer tasks typical of RHD tests.

There is one treatment under investigation for understanding metaphors (Lundgren et al., 2006). Currently, no other treatments for language disorders related to RHD have been empirically tested. Many treatments that address the symptoms have been suggested (see Myers, 1999; Tompkins, 1995). Other treatments that are theoretically based, such as emphasizing the use of context as opposed to simply generating multiple meanings, also have been suggested (Blake, 2007). Awareness of, and attention to, contextual cues may help minimize the effects of difficulties comprehending nonverbal cues.

Aprosodia

Prosody provides the melody of speech, and can convey meaning beyond the literal interpretation of the words in a sentence. Fundamental frequency, intensity, and duration all are manipulated to create varying intonation patterns during normal speech production to convey both linguistic and emotional information. Aprosodia is characterized by difficulties in the comprehension or use of these markers to signal linguistic boundaries or meaning (e.g., differentiating a question from a statement), or to convey emotion (Baum & Pell, 1999; Ross, 1981).

RHD batteries and specific tests for aprosodia can be used to diagnose aprosodia (e.g., Bowers, Blonder, & Heilman, 1999; Ross, 1981). The differential diagnosis must consider the presence of dysarthria, as some types of dysarthria share characteristics of aprosodia. Rosenbek and colleagues (Leon, Rosenbek, Crucian, Hieber, Holway, Rodriguez, et al., 2005; Rosenbek, Rodriguez, Hieber, Leon, Crucian, Ketterson, et al., 2005) have conducted studies on two treatments for aprosodia. One targets the motor speech aspect of the disorder, focusing on imitation of emotional prosody. The other treatment targets the cognitive- affect aspect of the disorder, focusing on the prosodic features used to express a particular emotion. Results of the phase I studies indicate that both treatments are efficacious, with gains maintained for several months.

◆ Attention and Neglect

Attention

Attention refers to the ability to focus on a particular stimulus or stimuli, either internal or external, and to filter out or ignore unwanted stimuli. Disorders of attention may be due to reduced attentional capacity, difficulties in assessing how much attention is needed for any given task, or problems allocating the needed amount of attention. RHD can create problems with focusing attention and filtering out distracters, sustaining attention over time, alternating attention between two tasks or stimuli, or diverting attention between two tasks or stimuli. Any attentional deficit may impact communication, as individuals may not be able to attend to incoming information for comprehension, or to resist distracting thoughts that may interfere with language processing.

Attention can be assessed through formal means, including specific attentional batteries or subtests for RHD or neuropsychological batteries. Observation of the patient in different settings (e.g., a quiet room versus a crowded waiting room or a physical-therapy gym) provides information about the patient's ability to focus, sustain, alternate, or divide attention.

Few studies have targeted treatment for attentional deficits specific to RHD. Sturm, Willmes, Orgass, and Hartje (1997) described attentional gains from a computerized treatment, although the gains were restricted to the type of attention treated (e.g., sustained versus alternating attention), with no generalization to other types of attention. Other treatments for attention generally result in gains for tasks similar to those conducted in therapy, with generalization to other behaviors noted in only some cases (see reviews in Cappa, Benke, Clarke, Rossi, Stemmer, & van Heugten, 2005; Cicerone, Dahlberg, Malec, Langenbahn, Felicetti, Kneip, et al., 2005).
Neglect

Neglect generally is considered to be an attentional disorder in which stimuli perceived by the sensory systems (e.g., vision, hearing) are not consciously attended to by the brain (Heilman, Watson, & Valenstein, 1985). Visuospatial neglect is diagnosed more often than auditory, motor, or somatosensory neglect, and will be the focus here. Despite the fact that objects are not consciously processed by the brain, unconscious processing of neglected items can occur. Neglect typically affects the side of external space contralateral to the brain lesion. Thus, an individual with neglect caused by RH will seem to "ignore" stimuli in the left side of external space. Neglect is not a single phenomenon, but can affect different regions or frames of reference (see sidebar).

Sidebar

Types of Neglect

Personal: Patient neglects the left half of his body, such as not dressing on the left side or not shaving the left side of his face.

Peripersonal: Patient neglects half of space within an arm's length, such as not eating food on the left side of a meal tray, not reading the left half of a page, or not being able to locate the remote control placed on the left bed stand.

Extrapersonal: Patient neglects half of space beyond an arm's reach, such as not noticing there is a window or TV in the room when they are on the left side of the room.

Viewer-centered neglect: Patient neglects the left side of space, where left is defined by the patient's midline. The left side will move as the patient turns his head.

Object-centered neglect: Patient neglects the left side of an object, regardless of where it is placed. He will neglect the left side of a picture even if the entire picture is placed in his right visual field.

Up to 80% of patients with RH exhibit visuospatial neglect (Barrett, Buxbaum, Coslett, Edwards, Heilman, Hillis, et al. 2006). Although neglect can resolve spontaneously during the acute stage, large lesions that affect three or more cerebral lobes or subcortical areas may cause persisting neglect (Maguire & Ogden, 2002).

Visuospatial neglect affects reading and writing as well as other language abilities. Individuals with an initial diagnosis of neglect, regardless of whether or not it resolved, have more difficulty with discourse tasks than those who never had neglect (Myers & Brookshire, 1996; Tompson, Bloise, Timko, & Baumgaertner, 1994).

Paper-and-pencil tasks are most often used to diagnose neglect, which creates a bias toward assessing and diagnosing neglect personal neglect (see sidebar, Types of Neglect). Sensitivity of traditional tasks such as scanning, cancellation, drawing, copying, and line bisection is variable, with most tasks identifying about 50% of cases (Linell, Jals, Tenovuo, Brunila, Voeten, & Hamalainen, 2007). Thus, a combination of tasks should be used to accurately diagnose neglect when it is present.

The most common treatment for neglect involves scanning tasks (Marly, 2002). Some treatments add a motoric component, so patients move either their left arm or left leg during scanning to increase activity within the right hemisphere (Bailey, Riddoch, & Cromie, 2002; Brunila, Linell, Tenovuo, & Hamalainen, 2002; Robertson, McMillan, MacLeod, Edgeworth, & Brock, 2002). These treatments generally result in improvement on scanning tasks, but do not necessarily generalize to functional tasks such as reading or writing.

Recent work on the use of external stimulation has shown decreases in the severity of neglect with relatively quick results that can last up to days (Barrett et al, 2006; Hillis, 2006). These treatments include left neck vibration, caloric stimulation (e.g., putting cold water into the external ear canal to induce nystagmus), prism glasses that deflect one visual field onto the opposing retinal field, and repetitive transcranial magnetic stimulation (rTMS), which serves to temporarily impede
function in the left hemisphere, allowing the right hemisphere to function without left-sided inhibition.

Other treatments that have been recommended but not empirically tested include encouraging unconscious processing by presenting stimuli that span the midline or that have differentiating information on the left side, or encouraging voluntary movement of attention by having the patient alternate between identifying items on the left and right sides of a page or a room (Myers, 1999). For object-centered neglect, interspersing large and small stimuli helps to increase the size of a patient’s “attentional window” so that he attends to the size of the large items and thus is less likely to neglect the smaller items. Circling or otherwise creating a border around stimuli also may aid in processing items within that area (Hillis, 2006).

**Cognition**

Cognitive abilities such as organizing, sequencing, reasoning, and problem solving are impaired in approximately half of adults with RHD admitted to a rehabilitation unit (Blake et al., 2002). Cognitive deficits associated with RHD are not well explained, and there is no single study measuring the range of cognitive deficits associated with RHD. Anosognosia, or a lack of awareness of deficits, is a specific cognitive deficit commonly associated with RHD.

Disruptions of cognition impact communication in various ways, and interact with other deficits previously described. Difficulties organizing and sequencing thoughts may lead to disjunct stories that are hard to comprehend or follow. Poor problem-solving ability may cause difficulties in determining how to repair conversational breakdowns, or figuring out the best way to convey emotions in the presence of aprosodia, for example.

Assessment can include the use of formal and informal measures. There are a variety of cognitive-communication assessments (e.g., Coelho, Ylvisaker, & Turkstra, 2005; Turkstra, Coelho, & Ylvisaker, 2005) that may be appropriate for RHD. Currently there are no treatments for cognitive deficits specifically for adults with RHD. Given the absence of evidence, one option for clinicians is to use treatments shown to be effective for specific disorders caused by other etiologies, such as traumatic brain injury (TBI) (e.g., Blake, 2007). Clinicians should be aware of limitations in the use of compensatory strategies in cognitive rehabilitation (e.g., Calvano, Levine, & Petrone, 1993). First, strategies or rules that are too specific may not generalize to similar tasks. Second, rules that are too general may be difficult to teach, and even more difficult for a patient to determine when and where to use them. Third, individuals with brain damage may have deficits in abstract thinking and problem solving that are necessary for successful use of strategies. For example, many treatments designed to treat pragmatic deficits rely on metalinguistic or metacognitive skills that may or may not be intact in patients with brain damage (Penn, 1999). Fourth, patients may not be able to reliably use strategies when they are in attentionally demanding situations. Ylvisaker, Szerkeres, and Feeney (2008) provide rationales and explanations for developing habitual use of strategies to compensate for cognitive

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**Sidebar**

Clinicians should be careful in their use of terminology to refer to deficits of awareness.

**Anosognosia**: Literally, not knowing a disease. Used to refer to lack of awareness of deficits, or the consequences of deficits, e.g., dense hemiparesis would impair the ability to drive.

**Denial of deficits**: Although typically used interchangeably with anosognosia, the word denial suggests that the person is aware of a problem or deficit, but is unwilling to accept or acknowledge it.

**Anodiaisphoria**: Reduced emotional reaction to deficits. A patient may acknowledge a deficit, such as hemiparesis, but seem not to care about it.
treatments for cog-

deficits. Although not empirically tested on ei-
ther TBI or RHD groups, these strategies may be
beneficial.

Anosognosia

Anosognosia, or reduced awareness of deficits,
may occur anywhere from 7 to 77% of indi-
viduals with RHD (Barrett et al, 2006; Blake
et al, 2002; Orfei, Robinson, Prigatano, Starkstein,
Rüsch, Bria, et al, 2007). It frequently occurs in
 conjunction with neglect. Patients with ano-
sognosia do not recognize their impairments, or
may not be fully aware of the limitations caused
by the deficits. This reduced awareness can oc-
cur even with dramatic physical impairments
such as dense hemiplegia (Barrett et al, 2006;
Orfei, et al, 2007). The presence of anosognosia
becomes particularly challenging in the clinical
setting, because a patient is not likely to par-
ticipate well in intensive therapy if she does not
recognize her problems.

There are a variety of questionnaires to de-
terminate the presence of anosognosia, but most
are limited in that they rely on self-report and
focus on physical deficits rather than cognitive
or communication deficits. There are no stud-
ies of treatment for anosognosia after RHD.

Cherney (2006) suggests that, when making
decisions about treatment for individuals with
cognitive-communication disorders and ano-
sognosia, clinicians should consider the medical
indications (diagnosis, prognosis); the patient's
preferences (although these are dependent on
the level of understanding and decision-making
ability); quality-of-life issues; and contextual
features, such as social, economic, and legal
circumstances.

**Conclusion**

Right hemisphere cognitive-communication dis-
orders can be difficult to detect and diagnose.
Their presence, however, can interfere with so-
cial and vocational activities, and can nega-
atively impact quality of life. The deficits tend to in-
terfere with pragmatics and the nuances of com-
munication. Researchers and clinicians should
work toward increasing education about RH dis-
orders, exploring more critically the underlying
deficits and their neural substrates, and creating
and testing treatments, so that we have evidence
to support our belief that what we do can and
does make a difference.

**Chapter Review**

**Discussion Questions**

1. Discuss how attentional deficits can im-
 pact communication, such as reading a
newspaper article and discussing it with a
spouse; having a conversation at home or
at a restaurant, etc.
2. Compare and contrast anosognosia, denial
 of deficit, and anosodia. Why is it im-
portant to differentiate them for the pur-
pose of assessment and treatment?
3. Discuss how a suppression deficit could
affect communication in daily life.
4. What precautions should you keep in mind
when adapting treatments for cognitive
deficits due to TBI for use with individuals
with RHD?
5. Discuss why RHD deficits are not as easily
labeled or defined as those associated
with lesions of the left hemisphere, such
as aphasia or alexia.
6. When working with a patient with neglect,
one commonly used technique is to say to
the patient, “Look to the left.” Explain why
this may or may not be effective (a) for
viewer-centered versus object-centered
neglect, and (b) in reference to Calvano
and colleagues' (1993) cautions about us-
ing compensatory strategies.
1. Cognitive-communication deficits associated with RHD
   A. generally are caused by lesions in the frontal lobe.
   B. are likely caused by damage to extensive networks within the right hemisphere.
   C. are most often linked to temporal lobe lesions.
   D. only appear with large lesions encompassing two or more lobes.

2. Peri-personal visuospatial neglect
   A. affects space further than an arm's length away.
   B. affects attention to one's own body.
   C. is the least commonly diagnosed type of neglect.
   D. can be detected using paper-and-pencil tasks.

3. Figurative language deficits are most often detected in
   A. naturalistic tasks.
   B. conversational speech.
   C. tasks requiring individuals to define idioms or metaphors.
   D. implicit tasks that do not require metalinguistic judgments.

4. Expressive aprosodia may be misdiagnosed as
   A. dysarthria.
   B. aphasia.
   C. anadiasphoria.
   D. anosognosia.

5. Treatment efficacy studies have been conducted on adults with RHD for which disorders?
   A. Neglect and anosognosia
   B. Cognition and aprosodia
   C. Neglect and aprosodia
   D. Discourse and pragmatics

Answers: 1: B; 2: D; 3: C; 4: A; 5: C.

References


Chapter 17  Right Hemisphere Damage


Cherney, L. R. (2006, Fall). Ethical issues involving the right hemisphere stroke patient: to treat or not to treat? Topics in Stroke Rehabilitation, 13, 47–53.


