THERAPEUTIC INTERDISCIPLINARY MANAGEMENT OF PERSONS WITH RIGHT HEMISPHERE STROKE

PART 1

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Description

• This session will review evidence-based interventions for patients with right hemisphere damage. The emphasis will be on mechanisms and procedures that enhance communication among PT, OT, SLP and nursing staff as well as maximizing combined, cumulative benefits for patients.

Disclosures

• Financial - I am being paid an Honorarium by ISHA
• Non-financial - None

Historical Perspective – Right versus Left Brain

• During 1980’s and 1990’s there was a trend to distinguish between right and left hemisphere functions in all of us
  — Based on Sperry and Gazzaniga research on “Split Brain” patients
  — Sperry won the nobel prize for medicine based on his research
• Left Brain – logical, linguistic, analytical, detail, serial
• Right Brain – creative, musical, visual, gestalt, parallel
The historical view

Historical perspective – Neurological

- Until 1990 – the right hemisphere was viewed as non-dominant
  - Lesions were relatively inconsequential
  - “Left Hemis” had visual spatial problems usually treated by OT
- In 1990’s Gardner and Brownell identified cognitive-linguistic deficits associated with RHD – especially use of metaphors
- Burns, Halper & Mogil (1982, later Tompkins identified pragmatic impairments

RHD Neurological Symptomatology
(Devinski and D’Esposito, 2005)

- Corporal Self Disturbances - relation of the body
  - To its affective state
  - To the environment
- Psychic Self Disturbances
  - Social self
  - Emotional self

RHD Corporal Self Disturbances

- Perception – visuospatial, somesthetic, auditory (melody and tone discrimination), olfactory, pain, emotional tone in voice and body gestures
- Constructional praxis –
  - Assemble and organize an object from disarticulated pieces
  - Disorders of dressing ability
### RHD Corporal Self Disturbances (continued)

- Nonlinguistic visuospatial functions
- Relation of self to the environment
- Body schema
  - Allesthesia — perception of a stimulus at a position remote from actual stimulus
  - Asomatognosia — failure to perceive a body part
  - Anosognosia — denial of deficit
  - Anosodiaphoria — indifferent to symptoms
  - Disorders of appetite

### RHD Psychic Self Disturbances

- Emotional perception
- Emotional expression
- Emotional cognition and memory (editor)
- Self-recognition
  - Alexithymia — diminished ability to identify and describe one's own feelings
  - Disturbance in emotion of familiarity
  - Volition — motor impersistence

### Psychic Self Disturbances (continued)

- Disorders of social self
  - Impoverished eye contact
  - Nonverbal emotional communication
  - Social language impairments
  - Disorders of ego boundary — “response to next patient stimulation”
- Delusional disorders
- Conversion disorders

### Psychic Self Disturbances (continued)

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Other Descriptions of Deficits

• Connie Tompkins and colleagues (2005, 2012)
  – Cognitive communication perspective
  – Alternate neurological perspective

Comorbidity

• Unilateral neglect commonly occurs in conjunction with
  – Anosognosia – denial of illness (correlation = .46)
  – Constructional deficits (correlation = .4)
  – Dressing difficulty (apraxia) (Correlation = .64)

Cognitive Linguistic Theories

Coarse Coding Deficit Hypothesis
(Beeman, Jung-Beeman)

• That the right hemisphere serves an important maintenance function for secondary meanings of words
  – Eg. Bank (financial institution vs. river’s edge)
• Beeman research highlights the role of the intact right hemisphere in mentally activating and maintaining activation of distant meanings or features of words, regardless of the larger linguistic context.
Suppression Deficit Hypothesis
(Tompkins, 2012)

- Nature of narrative comprehension difficulties after RHD
  - Eg. “The farmer’s pigs were crowded. He built a pen,” the contextually-inappropriate “ink” meaning of “pen” is initially active but quickly suppressed.
- 2 premises:
  - (1) when processing material that supports or induces competing interpretations, some adults with RHD who activate those interpretations will be delayed in suppressing whichever is contextually inappropriate, and
  - (2) interindividual differences in suppression function for such interpretations will predict comprehension of narratives by adults with RHD.

Pragmatic Deficits Hypothesis

- The pragmatic deficits account intersects with coarse coding and suppression deficit, in that behavior that is pragmatically deficient could be due to deficits in cognitive resource capacity or its allocation, in coarse semantic coding, or in the suppression mechanism.

Movement away from symptom-based methodologies

- Role of RH in cognitive processing networks
  - RH Attention – exogenous attention
    - To the ‘other’
    - To biological movement
  - Spatial reasoning
    - position of the ‘other’ relative to ‘me’
  - Emotion
    - Male v. Female differences in right hemisphere processes
    - Aprosodias (already covered)
    - Reading others’ minds – TOM
      - VIDEO – Right Temporo-Parietal Junction

Rebecca Saxe, et al., Neuroscience RH research updates

- Role of RTPJ
  - Exogenous Attention – may help to explain neglect and tangentiality
  - Theory of Mind – “Thinking about thoughts” and encoding moral beliefs – “metarepresentation”
- Role of RSTS
  - Understanding people’s actions – may help inability to respond to non-verbal communicative gestures
  - Response to repetition of movement
Saxe, 2006

- The developmental trajectory from attending to:
  - Human faces and bodies (infants),
  - to understanding goal-directed actions (toddlers),
  - to the uniquely human representational theory of mind (preschoolers),

- is reflected in the functional profiles of three regions in lateral occipitotemporo-parietal cortex

Cognitive Communication Disturbances (CCD) – later updated in ASHA position statement (2005)

- Blake and Tompkins (2005)
  - Attention (including visuospatial neglect),
  - memory,
  - problem solving,
  - reasoning, organizing, planning,
  - and awareness of deficits
Tompkins, 2012
Communication disorders that may have a substantial impact on social functioning

- Characteristics of expressive language and communication
  - Tangential,
  - Literal,
  - Aprosodic,
  - Verbose,
  - Socially inappropriate

- Evidence of anosognosia has been associated with
  - poor rehabilitation outcome
  - Increment of the risk of falls and
  - a greater exposure to dangerous behaviors

- These risks may be even greater for those patients who show a false awareness of their abilities by explicitly acknowledging their motor impairment but still misjudging the difficulty of bimanual tasks.

- These patients may possess a false sense of awareness of their own motor limitations, making them more prone to potentially risky situations.

Anosognosia (Cocchini, G., Beschin, N., & Della Sala, S. (2018)).

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<thead>
<tr>
<th>Metaphorical Language (Lundgren and Brownell, 2016)</th>
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<td><strong>Table 1. Assessment of Metaphor Interpretation Task (MAIT).</strong></td>
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Tompkins, 2012 Nonlanguage Cognition

• Nonlanguage cognitive performance has been hypothesized and demonstrated to underlie, covary with, or otherwise modulate communication in adults with RHD
  — Attention,
  — Memory, and
  — Executive functioning

Ross, Aprosodia (Pragmatic Deficits)

Lesion based view - Neurology of Affective Prosody and its functional-anatomic organization in right hemisphere

• Elliott Ross and Marilee Monnot
  — *Brain and Language* 104 (2008) 51-74

• Major findings:
  — Replication of Ross 1982, 1997
  — Aprosodia due to right hemisphere lesions is analogous to aphasia producing lesions and symptomatology seen with LHD
  — Affective prosody is lateralized to the right hemisphere

Aprosodia Battery Ross, et al 2007

• Production section: includes three Repetition tasks under decreasing verbal-articulatory demands and a Spontaneous task
  — Repetition: tape recording subjects on three tasks. Word, Monosyllabic and Asyllabic
    • Each set is comprised of 12 utterances,
      — two renditions each of six emotions (happy, sad, disinterested, neutral, surprised and angry)
    • The "sentence" carriers:
      — "I am going to the other movies" for Word Identification,
      — "ba ba ba ba ba ba ba" and for Monosyllabic Identification,
      — and a prolonged 'aaaaahhhh' for Asyllabic identification.
  — Spontaneous production of affective prosody is assessed by recording each subject during a 5-10 minute interview in which they are encouraged to discuss various emotionally provocative personal life events that made them feel happy, frightened, angry or sad.
Aprosodia Battery Ross, et al 2007 (cont.)

- Comprehension is assessed using three Identification tasks, Word, Monosyllabic and Asyllabic, and a Discrimination task.
  - Stimuli for the three Identification tasks are the same as for the Repetition tasks and consist of three sets of randomized utterances that are reduced progressively in verbal-articulatory content.
  - Each set consists of 12 utterances, two renditions each of six emotions (happy, sad, disinterested, neutral, surprised and angry) with one rendition having emphatic stress early in the utterance, and the other rendition having emphatic stress late in the utterance.
  - Subjects are asked to identify the emotional intonation of each stimulus by choosing the appropriate affect from a vertical array of six line drawings of faces expressing different affects.
  - Next to each face is the corresponding written label of “neutral,” “happy,” “sad,” “disinterested,” “surprised,” and “angry.”
  - Before testing, each subject demonstrated the ability to either identify the facial expressions or to read the written labels.

Ross and Monnot, (2007) Results – Left and Right Hemisphere impaired adults show problems with prosodic identification at the word level but with non-word tasks the adults with RBD are significantly more impaired

Support

- Injury to right frontal operculum produces acute deficits in the Spontaneous Production of affective prosody - Broca homologue does not
- Injury to right temporal operculum or thalamus and possibly the anterior putamen produces acute deficits in comprehension of affective prosody
- Injury to frontal but not others parts of the operculum predicts affective prosodic repetition deficits as measured by ability to vary fundamental frequency
Other findings

• Ross believes, prosodic impairment seen in LBD appears to be due to disconnection of collosal connections
  – [This is associated with apraxic characteristics of speech production in Broca’s aphasics – Burns]
• Prosodic impairment in basal ganglia lesions (ie. Parkinson’s Disease) may be due to cortical effects of dopaminergic deficiencies

Understanding RH problems with Attention including Neglect

Attention and Attentional disorders

• Functional attentional networks
  – Diffuse network – arousal and altering
    • Awakens, surveys internal milieu and extrapersonal space for relevant novel or changing stimuli
    • Acetylcholine and norepinephrine
    • Disorder - delirium
  – Mixed cortical-subcortical – orientation to stimuli
    • Disorders – progressive supranuclear palsy – impaired visual orientation and visually guided behavior
    • Posterior parietal cortex lesions – hyperattention to ipsilateral cues
  – Cortical network – mediates selective attention
    • Disorders - neglect


• During the first year after RH infarct, originally left-sided manifestation of neglect shifted toward milder non-lateralized attentional deficit.
• Ipsilateral orienting bias and slowed processing speed appeared to be rather persistent neglect-related symptoms both in neglect patients and patients with initially milder inattention.
• We propose some effortless, tentative ways of examining processing speed and ipsilateral orienting bias alongside the BIT to better recognize these neglect-related symptoms, and highlight the need to assess and treat patients with initially milder inattention, who have been under-recognized and under-treated in clinical work. (JINS, 2018, 24, 1–12)
Assessment tools that focus on visual neglect components of RHD

- Older tools that still have clinical efficacy
  - Behavioural Inattention Test
  - Burns Brief Inventory of Communication and Cognition
- Diller-Weinburg Visual Cancellation Test – Single Stimuli & Double Stimuli
- RICE - 3

Behavourial Inattention Test

Star cancellation task from the behavioural inattention test. Patients are asked to find and mark all the small stars without marking the large stars or letters. Patients with severe neglect find targets only at the ipsilesional side of the array.

Copying task from the behavioural inattention test. The patient tends to omit the left-sided elements of each object.

Diller-Weinburg Visual Cancellation Test – Single Stimuli & Double Stimuli

- A simple and test with two scanning tasks
  - Single Stimuli has a letter at the top and the patient is asked to find all letters in the lines below
  - Double Stimuli has two letters
- Available in the Cognitive Rehabilitation Manual published by ACRM
Group Interaction

- Discuss your standard RH assessment protocol
  - What areas are assessed preferentially by OT, Psychology, and SLP in your facilities?
  - What areas are not currently assessed that you believe need to be added?
  - What are differences associated with Acute Rehab settings, versus longer term rehab, versus ECFs, versus home treatment

For all therapists – The How of Therapy - Neuromodulation

Different dimensions of cortical plasticity are enabled by the behaviorally-context-dependent release of:

- acetylcholine (focused attention/reward) (Kilgard, Bao)
- dopamine (reward, novelty) (Bao)
- norepinephrine (novelty) (Bollinger)
- serotonin (Bollinger)
- et alia

In adults, learning-induced changes are complexly “nuanced” by differences in behavioral context that result in the differential release of 6 or 7 modulatory neurotransmitters.

Anosognosia: WILL Precede Other Therapeutic Considerations when Present

- The first step of treatment must be enabling the patient to understand the deficit
  - increase awareness by breaking tasks down into small components so the patient can see where the perception breaks down
  - have the patient describe the breakdown in their own words and repeat this to them often “I can see your eyes perfectly clearly and your teeth, but what those are no good without a body behind it”
1/5/2020

Unawareness for motor impairment and distorted perception of task difficulty

Other Considerations for increasing awareness of other RH issues in treatment (Tompkins, 2012)
• Rather than contradicting patients’ clearly unrealistic goals, members of the rehabilitation team engage patients in supported exploration and experience of subgoals.
• The aim of this approach is to improve patients’ awareness of gaps between their conditions or experiences and their goals, and to help them discard those goals, implicitly or explicitly, for alternatives. This approach must be
• Used with caution, in an empathetic and supportive manner, it may yield strong emotional responses in patients who begin to realize the extent and implications of their difficulties.

Neglect often an effective initial interdisciplinary treatment
• Neglect affects all aspects of rehabilitation
  – Motility - PT
  – ADL’s – OT and Nursing
  – Reading and Written Language

3 Treatments that received Level 1a or “strong” support in evidence-based reviews and one emerging (Riestra and Barrett, 2013)
• Visual scanning treatment Weinberg et al., 1977, 1979
• “Perceptual training” (Teasell et al., 2008)
• Prism adaptation training (Rossi et al., 1990; Rossetti et al., 1998) is an emerging therapy for which there is positive supportive evidence (see review of studies in Menon et al., 2009 and Priftis, K. et al, 2013)
Approaches to the spatial neglect syndrome (Riestra and Barrett, 2013)

- **Restorative or restitutive**
  - Goal to reinstate premorbid capacity of injured brain-behavior systems via visual, tactile or auditory stimulation cuing,
  - gradually reduced and then eliminated,
  - with integration of engaging activities

- **Vicariative**
  - Goal to activate a system closely related to or sharing key components with spatial cognitive systems in order to increase spatial activation.
  - For example, patients might be asked to walk and encouraged to advance the hemiparetic left leg,
  - while they are simultaneously instructed to monitor their body spatial position or take note of physical details of their surroundings.

- **Compensatory approach**
  - may involve counseling the family about safety issues,
  - arranging for the patient’s immediate environment to be visually simplified.

“Zone of Proximal Development”

- New concepts/skills are maximally learnable/processed because
  - they should be just difficult enough to engage the client/patient
  - yet easy enough to maintain high spirits

Restorative Interventions

VST - Practice Standard for Neglect

- Visual scanning training (VST), targeting mainly viewer centered spatial neglect, has been endorsed as a practice standard.
- VST has many variants, but in general, requires patients to consciously distribute their attention broadly, to targets that appear in both visual fields.
- Improvement has been reported to generalize to functional reading, writing, and motor tasks, with long-lasting gains in some cases.
- Using more complex stimuli seems to improve generalization effects.
- Can use Lighthouse Strategy or other visuospatial strategies (boundaries, verbal cues, etc.)

- With any task requiring visual attention:
  - Picture of lighthouse placed in farthest spot of L visual field
  - Pt imagines his/her eyes are the beam – sweeping all the way to the left and the right of the horizon to guide ships to safety

Lighthouse Strategy (continued)

1. With scanning sheet or objects on table, therapist asks, what if the light could only stream to the right?
2. Introduce visual stimuli on the table-top in a range the pt should be able to scan to assure pt can succeed
3. If pt misses some, say, “Look you missed _____ on the left – do it again and pretend you are the lighthouse – therapist can model head turning
4. Move to room – identify objects on left and right walls – use tactile or verbal cues as necessary
5. Eventually can move to ambulation, identification of people or objects in a room

General Treatment Guidelines: paper pencil tasks for use by OT, SLP, at home

- Responds well to therapy using techniques that increase attention to perceptual cues
  - Graphic grids
  - Red or yellow reference lines (boundaries)
  - External space organizers – eg. Cards, straight edges, etc. (Boundaries)
  - Teaching internal spatial representation strategies, eg. “edgeness” therapy

Computerized Visual Scanning Training

- Pizzamiglio et al (1992) established procedures. Not recommended as a standalone but can be used in conjunction with paper pencil tasks.
- Procedures are also available in Cognitive Rehabilitation Manual ACRM (2012)
Visual Scanning Training for Reading and Copying Prose (Cognitive Rehabilitation Manual ACRM 2012)

- For Neglect Dyslexia
  - Establish patient understanding of problem
  - Printed materials taken from large-print documents (newspapers, Reader's Digest, books)

1. Start with large print sentences with simple realistic content.
   - Progress to a four-line paragraph and gradually increase to 10-15 and fifteen line passages
   - Place red (or yellow anchor line to the left)

2. Begin with minimal cues needed to accurately read the materials (cues can be tactile)
3. Therapist should observe behavior and not permit misreading of words
4. Use whatever cues are necessary to get patient to the next line
5. Progress by increasing length and complexity

To enable a patient to visualize the left hand margin, in the beginning it is helpful to use a red or yellow line down the left hand side of the margin.

You can begin with longer lines and then gradually shorten the lines requiring the patient to move to the left more frequently.

Often an index card with a red or yellow symbol in the upper left hand corner can be used as a cue – by keeping the symbol on the yellow line the patient can move down line to line in the reading selection more quickly. Gradually the patient can be weaned from the card.

- Action observation (AO) is defined as a dynamic state during which an observer can understand what other people are doing by simulating the actions and the outcomes that are likely to follow from the observed motor act.
- Gatti et al. showed that AO is better than motor imagery as a strategy for learning a novel complex motor task, at least in the early phase of motor learning, thus emphasizing its role in neurorehabilitation.


- 20 different daily routine tasks (actions) carried out with the upper limb
- Patient presented one task per day, from easiest to most complex - in 20 sessions, for 4 weeks (5 sessions/week). Unimanual and bimanual tasks
  - Each action consisted of three different meaningful motor sequences displayed in order of ascending difficulty and lasting 3 minutes each.
- Tasks relevant ADLs e.g. drinking from a glass, combing hair, opening a box, eating an apple, and object and goal-directed. E.g. 3 acts for, take and drink a cup of coffee:
  - 1) reach and grasp the handle of the cup with the affected arm and return to the starting point;
  - 2) reach and grasp the handle of the cup with the affected arm; rise the cup towards the mouth; return to the starting point;
  - 3) reach and grasp the handle of the cup with the affected arm; rise the cup towards the mouth and drink; then, return to the starting point.
- Control tasks: Subjects shown 5 static images displaying non-manipulable objects, (pictures of buildings, trees, cruise ships, mountains, beach umbrellas, beds, and tables) for 3 minutes.

Action Observation Step 1

1) reach and grasp the handle of the cup with the affected arm and return to the starting point.
Action Observation Step 2

(2) reach and grasp the handle of the cup with the affected arm; rise the cup towards the mouth; return to the starting point;

Action Observation Step 3

3) reach and grasp the handle of the cup with the affected arm; rise the cup towards the mouth and drink; then, return to the starting point.


- This study shows that action observation can stimulate and enhance the beneficial effects of motor training in left hemiparetic patients undergoing intensive rehabilitation in the subacute phase of ischemic stroke.
  - Observation of action, with the intention to imitate movements, can increase the excitability of the brain motor areas and, in doing so, can stimulate the recovery of motor control.
- Moreover, in addition to what has been already described by others, we hypothesized and observed that action observation, coupled with action execution, induces a higher improvement in right hemispheric compared to left hemispheric strokes.

Videos of patients with Neglect - Group Discussion

- In small groups - discuss the following interdisciplinary approaches:
  - How can the lighthouse strategy be used on the unit by nursing, and at home with the family?
  - Discuss 5 or 6 Action Observation activities that could be incorporated during Speech Therapy, and at home with patients seen in the videos.
Q & A