Cognitive-Linguistic Assessment & Management in Neurogenic Communication Disorders

Heather Harris Wright, PhD, CCC-SLP
East Carolina University
Greenville, NC

• In the Morning…
  – Neuroanatomy & neurophysiology
  – Healthy aging
  – Evaluating & Managing Cognitive-linguistic abilities in MCI & dementia

• In the Afternoon…
  – Cognitive and linguistic processes in aphasia
  – Treating cognitive-linguistic impairments in aphasia

Overview of Neuroanatomy & Neurophysiology
Complex Brain Functions

- We are unique
- We have awareness of physical & social circumstances
- Ability to have & share thoughts and feelings
- Intrinsic aspect of this = difficulty unraveling neurobiological underpinnings

Lesion studies
- Functional brain imaging techniques
- Electrophysiological experiments in primates

Phineas Gage

In 1848, a 25 y.o. railroad construction worker survived an unbelievable accident. A massive iron bar was propelled through his left cheek and skull. Shortly after the blast, he regained consciousness & was carted off to the town physician. He greeted the Dr. with "Doctor, here is business enough for you"
• Physically he healed within 2 months
• However... he was a different person
  – Was now impatient & rude
  – Had outbursts of anger & rage
  – Could not follow a coherent plan of action

• Experienced violent epileptic seizures
• Died in 1861 at age 38
• Buried with the tamping iron
• His injury has been examined and reexamined (Damasio et al., 1994; Ratu et al., 2004)
Language and the Brain

- Language is complex
- Involves primary, secondary, & association cortices
- For most, language is located in the left hemisphere → dominant hemisphere
- Distinct regions in frontal & temporal association cortices are important for language

- Neural substrates for language transcend essential motor & sensory functions
  - I.e., grammatical rules, appropriate tone, pragmatics

- Neural substrates for language known b/c of brain damage
  - Aphasias
  - Paul Broca & Carl Wernicke
- Also able to map language function b/c of invasive & noninvasive techniques
  - Wada test
  - Brainmapping (neurosurgery)
  - Positron emission tomography
  - Functional magnetic resonance imaging
• Difference in language function between right and left hemisphere → structural correlates of behavioral asymmetry
  • Planum temporale – (superior aspect of temporal lobe) significantly larger in left hemisphere in 2/3
    – Association should be regarded cautiously
    – PT asymmetry evident in about 67% population BUT 97% population has language in left hemisphere

• Role of the right hemisphere in language
  – Can have a language deficit following right hemisphere damage
  – Suprasegmentals most often affected
  – Also involved in pragmatics, complex linguistic processing

Mental functions: Frontal lobe
• Premotor cortex
• Motor strip
• Broca’s area
  – Involved in generating message
• Dorsolateral frontal lobe
  – Involved in executive function & working memory
• Cingulate gyrus
  – Important for memory & basic limbic function
Mental Functions: Parietal lobe
- Sensory strip (BA 1-3)
- Inferior frontal lobule
  - Includes angular gyrus and supramarginal gyrus
  - Association area
    - Left: associated with language, reading & naming
- Superior parietal region
  - Responsible for visuospatial & constructional functions

Mental Functions: Temporal lobe
- Superior temporal gyrus
  - Primary auditory cortex
  - Left STG: critical for auditory comprehension
  - Wernicke's area
- Right temporal lobe
  - Rhythm and music
- Medial temporal areas → hippocampus
  - Involved in memory
Association Cortices

- Responsible for complex processing
  - Parietal association cortex – important for attending to complex stimuli in the internal & external environment
  - Temporal association cortex – important for identifying the nature of such stimuli
  - Frontal association cortex – important for planning appropriate behavioral responses to the stimuli

Memory and the Brain

- Much of our knowledge in this area is based on lesion studies
- No specific area in the cortex has been isolated as subserving memory
- Memory involves neural systems active in other cognitive and linguistic functions
• Medial temporal lobe appears to play an important role in memory
• It includes the amygdala, hippocampus, entorhinal cortex
• Some thoughts...
  – Hippocampus involved in transferring information from transient to LTM
  – Neocortex (inferior frontal & anterior temporal) involved in working memory

MCI and Dementia

DSM IV vs DSM - V

**DSM - IV**
- Delirium, dementia, and amnestic & other cognitive disorders
- Dementia or other debilitating conditions

**DSM - V**
- Neurocognitive disorders (NCDs)
  – Mild
  – Major
- Mild NCD is a new dx
  – May progress to dementia but may not
Mild NCD

- Noticeable decline in cognitive functioning from a previous level
- Requires individual to use compensatory strategies & accommodations to maintain independence and perform ADLs
- Does not interfere with independence
- Heterogeneous category
- Etiologies for mNCD not coded in DSM-5

What we know about mNCD comes almost exclusively from MCI research but...

- mNCD more diverse group of entities
- Includes mild acquired impairments
- Impairments may be transient, static, or reversible

Mild Cognitive Impairment

- Change in cognition reported by patient or clinician
- Objective evidence of impairment in one or more domains
- Preservation in functional abilities
- Not demented

NIA-AA Workgroup (Albert et al., 2011)
• Alzheimer’s Dementia
  – Most common cause of dementia
    • 5-10% over 65 y.o & 15-30% over 80 y.o.
    • About 13 million cases and increasing
  – Over 50% of NH residents → DAT
  – Lifespan after diagnosis
    • About 3-20 years

• Characterized by changes in brain neurons
  – Neurofibrillary tangles – become twisted, tangled, distorted
  – Neuritic plaques – granular deposits; tissue degeneration
  – Granulovacuolar degeneration – fluid-filled cavities containing granular debris appear in nerve cells
From Alzheimer’s Association

Healthy Aging

Brain Reserve & Cognitive Reserve

- Independent
- Interactive in explaining individual differences in cognitive & functional resilience of brain pathology (Tucker & Stern, 2011)
Brain Reserve

- Brain’s capacity to sustain a certain amount of pathological change before clinical symptoms emerge
- Quantitative measures
  - Brain size
  - Neuronal count

Cognitive Reserve

- Ability to use alternate cognitive strategies to optimize maximal performance on cognitive tasks (Baldivia et al., 2008)
- Conceptualized as... ability to build reserve through demanding & stimulating experiences

Brain Reserve requires greater pathology for emergence of clinical deficits

Brain injury effects the same but... individual differences observed in brain reserve

Cognitive Reserve Hypothesis –
Individual differences in how tasks are processed provide reserve against brain pathology

Higher IQ, education, occupation level, participation in leisure activities

Secondary education can delay DAT by 5 years

Cognitive Reserve…
  • Accomplish more
  • Compensate better for pathology
  • Compensates well in early stages
  • Protects against

Patients with high CR require…
  • Greater decrease in cortical thickness
  • Higher levels of amyloid peptides in CSF
  • Greater regional atrophy

For clinical changes to be observed
Diagnostic Challenges…

- Pathological changes but no clinical symptoms
- Mismatch between clinical severity & pathological changes

Cognitive reserve interventions are a possible **key** to preventing or pushing off disease (Tucker & Stern, 2011)

Principles of Healthy Aging

- Physical fitness
- Intellectual fitness
- Social fitness
- Purpose fitness
• More than disease prevention
• Optimal well-being in spite of specific disabilities
  – Healthy aging AND have a disability

• Healthy aging strategies
  – Prevent, postpone or reverse adverse health conditions
  – Maintain a/o recover function after health problem
  – Enhance QOL via physical & emotional well-being
  – Compress disability to end of life span

– Minimize incidence of illness through life
  ↑ participation in health maintenance & enhancement activities
Communication & Healthy Aging

- Vital role
  - Inextricably linked to social health & psychological well-being
  - Loneliness in older adults is a better predictor or death than smoking or high cholesterol

Linguistic Changes in Healthy Aging

- Discourse - microlinguistic and macrolinguistic processes
- Age-related changes and differences at discourse level
- Communication style and intention
  - Changes across the adult lifespan

Why we care about the discourse level

Naturally occurring form of communication that involves activation and interaction of multiple interconnected cognitive and linguistic subsystems (Fergadiotis et al., 2011)

Communication occurs at discourse level
What we need to consider with discourse

- Discourse types
  - It matters
- Discourse processes
  - Microlinguistic processes
  - Macrolinguistic processes

(Common) Discourse Genres
- Narratives
  - Stories & picture descriptions
  - Recounts & accounts
  - Procedures

Microlinguistic Processes
- Linguistic units of discourse including lexical and syntactic features
• Informativeness
  – Word choices that are informative to the discourse
• Richness of vocabulary
• Syntactic complexity

• Age-related changes?
  – Some...
• Informativeness
  – Age-related declines in older (75+) adults (Marini et al., 2005)
• Productive vocabulary
  – Age-related increases in older compared to younger adults for some tasks (Fergadiotis et al., 2011)

• Content errors
  – Paraphasias
  – Indefinite words (nonspecific/ambiguous words)
• Differences… it depends...
  – Marini et al. (2005) reported more paraphasias in picture descriptions by 75+ year olds
  – Cooper (1990) reported more indefinite words in picture descriptions in older v. younger adults
• Syntactic complexity
  – No age-related differences in syntactic errors or number and type of noun phrases but...
  – Older adults produce few embedded clauses than younger adults (Kemper et al., yr; Marini et al., 2005)

• Why???
  – Age-related changes in working memory ability

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### Age-Related Changes

- Some semantically-related paraphasias
- Increase in use of indefinite words
- Increase in richness of vocabulary
- Simpler sentence structure
- Age-related changes are often discourse type dependent

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### Disease-Related Changes

- Word retrieval errors may include paraphasias, neologisms, nonreferential terminology
- Decrease in richness of vocabulary
- Syntactic errors > simplified syntactic structures
- Disease-related changes are less sensitive to discourse type

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### Macrolinguistic Processes

• Interrelatedness of discourse units — coherence, cohesion, accuracy & completeness of conveying stories and procedures

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• **Coherence** is the listener’s ability to interpret the overall meaning conveyed by the speaker
  – Discourse schemas, cognitive abilities and age can contribute to discourse coherence

• Global coherence – thematic unity of discourse
• Local coherence – maintain meaning from previous discourse unit to the next unit

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Global Coherence

Picnic Story

“one day the mouse family decided to go on a picnic”
“they load up all their children into the back of their pickup truck”
“and they set out on a long and bumpy road to where they are going to be enjoying their lunch”
“the road is up hill and down hill and very rocky”
“and it’s very hard for the mice children to stay in the back of the pickup”
“when they hit a particularly large rock the youngest mouse falls out and onto the road”

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Global Coherence

![Diagram with Overall Topic and Utterances 1-4 connected with arrows]
Local Coherence

Picnic Story

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Local Coherence

- Age-related differences in coherence… depends
- Measures differ
  - Rating scales
  - Degree of coherence
  - Coherence errors
- Other behaviors that influence coherence → off-topic speech
• Off-topic speech – when the speaker abandons the topic
  – Minimal affect on local coherence
  – Significantly impacts global coherence
• Older adults have more instances of OTS than younger adults (Arbuckle & Gold, 1993; James et al., 1998; Pushkar et al., 2000; Trunk & Abrams, 2009)

• Increase in OTS leads to poorer maintenance of global coherence
• But… often perceived as better story tellers
  – More expressive
  – More interesting
• Why??
  – Different goals for communication…

CASE EXAMPLES
Communication Style and Intention

Goals of Communication …
– Fascinating – focus
– Entertaining – simple
– Education – objective

• Older adults value expressive and objective goals when communicating regardless of the topic
• Younger adults’ communication goals are dependent on the topic

Trunk & Abrams (2009)

• Discourse produced reflects value on communication
  – Procedures – older adults are rated as less focused, less clear, and more talkative
  – Episodic topics – no difference between age groups ➔ expressive, clear

Communication goals shape the discourse a person chooses to use
Value in communication has a broader effect...

- Inextricably linked to social health & psychological well-being

- What isn’t… education, baseline cognitive level, demographic information, SES, chronic medical condition, level of physical activity (Barnes et al., 2004)

- Higher number of social networks and social engagement are associated with reduced rate of cognitive decline (Barnes et al., 2004; Meijer et al., 2009)

Social network: structure and quality of personal relationships

Social engagement: participation in socially meaningful, productive activity

Evaluating & Managing Cognitive-linguistic abilities in MCI & Dementia
Diagnosing MCI...

- Complex sustained attention
- Semantic memory
- Working memory
- Episodic memory
- Selective attention

Need combination of measures to accurately diagnose & reduce false positive


Brief Tests

- Blessed Dementia Scale (BDS; Blessed et al., 1968)
  - Similar to FIM
  - Scores 0-28
- Mini-Mental Status Examination-2
  (Folstein et al., 2003)
  - 5-10 minutes
  - Assesses 6 areas

- Dementia Rating Scale-2 (DRS-2; Mattis, 2002)
  - Quick tasks
  - Purchase
- Global Deterioration Scale (GDS; Reisberg et al., 1982)
  - Detailed descriptions of seven levels
  - L2 & L3 → MCI
- Clinical Dementia Rating Scale (CDR; Morris, 1993)
  - Subjective rating system
• Addenbrooke’s Cognitive Examination-R (ACE-R; Mioshi et al. 2006)
  – 30-minute test
  – Detects early stage Alzheimer’s

• The Brief Cognitive Assessment Tool (BCAT; Mansbach et al., 2011)

• NIH Stroke Scale (NIHSS)
  – Nihstrokescale.org
  – Sections 9, 10, & 11
  – Language, dysarthria & extinction/inattention

• Formulaic and Novel Language Comprehension Test (FANL-C) (Kempler & Van Lancker Sidis, 1996)

• St Louis University Mental Status (SLUMS; Tariq et al.)
  – Considers education
  – mNCD & Dementia

• Montreal Cognitive Assessment (MOCA)
  – Paper
  – Many languages
  – App
  – Short version
Standardized Test Batteries

• Arizona Battery for Communication Disorders (ABCD; Bayles & Tomoeda, 1993)
  – Best known
  – Consists of 14 subtests

• Functional Linguistic Communication Inventory (FLCI; Bayles & Tomoeda, 1994)
  – Covers everyday language and communicative behaviors
  – 30 minutes to administer

Management of Cognitive-Linguistic Abilities

Treating & Counseling for MCI

• Beneficial behaviors
  – Engage in mental activity
  – Engage in physical activity

• Social Needs
  – Encourage & facilitate social interactions
  – Provide community resources for patient & caregiver
  – Discuss driving safety, home safety (kitchen, falls, etc…)

Langa & Levine (2014)
Neuroplasticity and cognitive reserve

Cognitive Intervention can result in measurable neural changes

WHY? Retain cognitive abilities to learn & apply new information & strategies

Cognitive Intervention Program

• Target > 1 cognitive process
• Use different criteria for measuring progress
• Vary intensity & duration
• Individual and/or group treatment

Prevent or delay cognitive decline

• Group format is ideal
  – Built-in opportunity for social engagement
  – 1 day/wk 8-12 weeks
  – 15-30 minutes daily home practice
  – Daily practice log
  – Booster sessions
• Action-oriented, practical, meaningful
<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Content</th>
<th>Time Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language &amp; Cognition</td>
<td>Direct intervention</td>
<td>Individual 30 minutes then incorporate in all group activities</td>
</tr>
<tr>
<td></td>
<td>Home Program</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Educate about aging brain &amp; healthy brain habits</td>
<td>15-30 minutes 5 days/wk</td>
</tr>
<tr>
<td></td>
<td>Incorporate healthy brain habits in daily life</td>
<td></td>
</tr>
<tr>
<td>Active Engagement</td>
<td>Social Interactions</td>
<td>30 minutes in group</td>
</tr>
<tr>
<td></td>
<td>Community Participation</td>
<td>Incorporate weekly</td>
</tr>
<tr>
<td>Functional Strategies</td>
<td>Selection &amp; training of strategies</td>
<td>30 minutes</td>
</tr>
<tr>
<td></td>
<td>Guide home practice</td>
<td>Use strategies daily</td>
</tr>
</tbody>
</table>

McCullough (2014)

Pharmacological Management

- Acetylcholinesterase inhibitors
  - Approved all stages in USA
  - Donepezil (Aricept)
- Memantine – NMDA receptor antagonist
  - Approved moderate to severe
  - Off-label for mild DAT and MCI

- Available evidence supports use of AChEIs or memantine for patients with severe DAT
- Combination therapies inconsistent
- Memantine not indicated for mild DAT or MCI
- No definitive evidence supporting use of antidepressants in patients with depression & dementia
- Psychosis & agitation is a clinical challenge

Schwarz et al., (2012)
Spaced Retrieval Therapy

- Developed by Camp and colleagues
- Can purchase it…
  - notebook with evidence-based review of SRT
  - Example activities
  - Screening information

Spaced-Retrieval Screening

1. (NO DELAY) “Today we are going to practice remembering my name. My name is ______. What is my name?”
Correct: “That’s right. I am glad that you remembered.”

2. (SHORT DELAY) “Good. I will give you more opportunities to practice as I am working with you today. Let’s try again. What is my name?”
Correct: “That’s right. I am glad that you remembered.”

3. (LONG DELAY) “You are doing well remembering my name for a longer period of time, and that’s the idea. I would like you to always remember my name. I will be practicing this with you during therapy by asking you often. What is my name?”
Correct: “That’s right you are remembering for a longer period of time. You did a great job remembering my name.”

The Technique

- Used to recall specific facts, strategies, precautions, etc.
- Can incorporate errorless learning – does not allow client to make errors!
  - Give cues as necessary (e.g., visual, physical, verbal)
**Examples of SRT**

- **Repetitive questions**
  - SLP: “You live at Menorah Park. Where do you live?”
  - Res: “I live at Menorah Park.”

- **Using external cues**
  - SLP: “If you want to know what activities we have planned today, you can read this schedule. Where can you look to find out what is planned for the day?”
  - Res: “I can go here to read this schedule.”

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**Spaced-retrieval can be used to teach a wide variety of skills, facts, such as:**

- Hip/weight bearing/sternal precautions
- Use of cane, walker, wheelchair
- Room #, place of residence
- Schedules: for family visits, meals, etc.
- Intelligibility/word finding/memory strategies
- Positioning: keep feet on foot rests, keep arm on tray, etc...
- Key steps in creative activities
- Taking medicine
- Important dates: e.g., birthdays, anniversaries, etc...

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**Group Approaches**
• Group activities facilitate participation and engagement
  - Strength-based programming (Eisner, 2001)
  - Breakfast Club (Santo Pietro & Boczko, 1997)
  - Question Asking Reading (QAR) (Stephens, King, & Camp, 1993)

### Strength-based Programming

<table>
<thead>
<tr>
<th>Intelligence Types</th>
<th>Example Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal-linguistic</td>
<td>Communication cards &amp; word games</td>
</tr>
<tr>
<td>Logical-mathematic</td>
<td>Puzzles, board games</td>
</tr>
<tr>
<td>Visual-spatial</td>
<td>Crafts &amp; picture games</td>
</tr>
<tr>
<td>Tactile-kinesthetic</td>
<td>Dance, exercise</td>
</tr>
<tr>
<td>Auditory-musical</td>
<td>Music, games with sounds/songs</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>Discussions, story telling</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>Writing, journaling, solitaire</td>
</tr>
<tr>
<td>Naturalistic</td>
<td>Picnics, walks, gardening</td>
</tr>
</tbody>
</table>

### Question Asking Reading (QAR)

1. **Orientation:**
   - General talk about the day’s activity, reality orientation information such as day, date, and surroundings, and introduction to the passage.

2. **Distribute Cards**
3. **Distribute Text**
4. **Group Reading**
• Support Cards – to prompt discussion in QAR
  – Ask about a word that is hard to say
  – Ask about a word that is hard to understand
  – Ask about the main idea
  – Ask about what happens next
  – Ask about a specific detail in the story
  – Ask if anyone knows additional information on this topic

• FOCUSED (Ripich & Wykle, 1996)
  – F: Functional and Face to attract attention
  – O: Orientation to topic of conversation
  – C: Continuity, or maintenance of the topic
  – U: Unsticking for overcoming communication blocks
  – S: Structure of questions
  – E: Exchange and Encourage
  – D: Direct types of verbal messages
### More Strategies for Caregivers

- Short, simple sentences
- Speak slowly
- One question at a time
- Maintain eye contact
- Eliminate distractions
- Repeat messages and paraphrase

### Education Topics

- Appropriate for Interdisciplinary collaboration
- For professional and personal caregivers
- Topics:
  - Dementia – all about it
  - Medical care
  - Support groups
  - Counseling services
  - Transportation services
  - Nursing home and HHC services

### Multi-Level/Multi-Modal Management

- Basic support
- External environment
- Physical
- Cognitive & psychosocial activity

*Patient-centered or Caregiver-centered*
What should we strive for?

- To provide environments that:
  - promote functional behavior, e.g.,
    - familiar, homelike, appropriate for adults
    - reminiscence, socialization, as well as PRIVACY
  - compensate for deficits, e.g.,
    - Understanding and unambiguous (maximal contrasts, reflection-free)
    - Provide general cues for orientation, activities, etc.
    - Provide specific cues for individual needs

[Holland, 1998]