Stroke and Hemispatial Neglect

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Objectives

• Outline the characteristics of the three most common forms of hemi-neglect as a result of a stroke
• Define current interventions for hemi-neglect
• Discuss evidence based interventions for hemi-neglect
• Discuss the value of research translation in implementation of hemi-neglect interventions
Epidemiology of Stroke and hemineglect

• 25-30% of all stroke patients
• Some disorder become chronic
Definition

- Neuropsychological condition
- Right cerebral hemisphere lesions
- Decreased tendency to respond and scan for stimuli to the left part of the patient’s space
- Damage to the sensory and motor integration area of the brain
Supramarginal Gyrus

• Essential for spatial attention
MR imaging of hypoperfusion associated with neglect
Three major categories of attentional deficits

- Memory and representational deficits
- Action-intentional disorders or motor neglect
- Inattention or sensory neglect
Memory

- Extrapersonal space is stored with a body-centered coordinate system
- Right parietal lobe damage
- No evidence of visual perceptual neglect
Motor Neglect

- Not a deficit of the motor pathway
- Failure or decreased ability to move in the contralesional space
- Motor neglect in the eyes, head, limbs, or trunk
Inattention or Sensory Neglect

- Lack of awareness or decreased awareness of sensory stimulation
- Decreased ability to respond to stimuli to the left space of the patient
Hemineglect - Sequelae

- Presence in the first 10 days immediately following a stroke
- Poor functional recovery
- More falls
- Longer to rehabilitate
- Less independent
Confounders of hemineglect

- Age
- Severity of paresis
- Sensory deficits
- Anogognosia
- Hypertonia
- “Pusher syndrome”
- Right hemispheric Stroke
Complications of hemineglect

- Affects cognition
- Activities of Daily Living (ADL)
- Ability to live Independently
- Functional recovery
- Safety
- Falls
Complications of hemineglect

- Groom only half of their face
- Shaving only half of their face
- Applying only half of their face
- Colliding with objects or people
- Causing injury to self
- Causing injury to others
Complications of hemineglect
Complications of hemineglect

- Groom only half of their face
- Shaving only half of their face
- Applying makeup on only half of their face
- Colliding with objects or people
- Causing injury to self
- Causing injury to others
Complications of hemineglect
Testing

- Berg Balance Scale
- Functional ambulation categories
- Barthel ADL index
Berg Balance Scale

- 14 item test to calculate standing balance
- Sitting up without assistance
- Standing up with eyes closed
- Standing on one foot
- Transferring positions
- Bending to pick up items on the floor
- Climbing on a stool
- While standing, reaching forward
Berg Balance Scale
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Functional Ambulation Categories

- **0**: Cannot walk, or needs help from 2 or more persons
- **1**: Needs firm continuous support from 1 person
- **2**: Needs continuous or intermittent support of one person for balance and coordination
Functional Ambulation Categories

- **3**: Requires verbal supervision, but no physical contact or help
- **4**: Walk independently on level ground, but needs help on stairs or uneven surfaces
- **5**: Walk independently anywhere
Barthel ADL Index

- Feeding
- Grooming
- Dressing
- Transfer
- Bladder
- Bowel
- Toileting
- Walking
- Stairs
Visuospatial Neglect
Testing
Testing
Testing – Star Cancellation Test
Testing - Midline
Testing

- Visual Field Loss – Patient turn their head to compensate for their deficit
- Visual and Sensory Neglect – Patient turn their head away from their hemi-inattention side
**Hemianopia and Neglect**

- Hemianopia without neglect
- Neglect with full visual fields to confrontation

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<tr>
<td><strong>Right homonymous hemianopia</strong></td>
<td><strong>Binasal hemianopia</strong></td>
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Hemianopia - Right homonymous hemianopia
Hemianopia – Binasal
Hemianopia – Left superior homonymous quadrant anopia

Left superior homonymous quadrant anopia
Hemianopia - Bitemporal

Bitemporal hemianopia
Extinction

- Full visual fields but fails to report contralesional stimulus when presented with bilateral simultaneous stimulus.
Treatments

• Contralesional hand stimulation
• Visual scanning
• Mirror therapy
• Constraint-induced movement therapy
Treatments

• “Attentional window” for stimulus
• Presenting large circles in the same block of trials with small circles with left-sided or right-sided targets
• Improved detection of left-sided targets in the small circles (but not in the large circles)
Limb Activation

• Using the patient’s own left arm in the left hemi-space
• Significantly reduced neglect compared to no movement, right hand movement or left hand movement in the right hemisphere
Limb Activation

Neglect Alert Device (NAD) emits a loud buzzing noise and a red light if the switch is not pressed within a predetermined time interval. Device is placed in the left hemi-space. Patient is required to press the switch with his impaired left arm to turn off the buzzer during a variety of situations.
Limb Activation

• Significant long term gains in ADL:
  - reading
  - walking strategy
  - dressing
  - cleaning
  - feeding
  - meal preparation
Therapy: Visual Scanning

• Re-orientation of visual scanning toward the neglected side by using explicit instructions to look at a red line to the left of the page before beginning the exercise
Prism Adaptation

• Lateral shift of the visual field so that the visual target appears at a displaced position
• Adaptation to such an optical induced shift critically requires a set of successive perceptual-motor pointing movements.
• Virtual position of the target
• Subsequent pointing movements ensure that the pointing error rapidly decreases so that subjects can readily point towards the real target position
• Initial error reduction comprises a “strategic component” of the reaction to the prism
• Not necessarily produce adaptation at this stage
Prism Adaptation

Optical effect of rightward prism induced shift

Start of prism adaptation period

End of prism adaptation period

Post-adaptation (after effect)

Prisms on

Prisms on

Prisms off
Prism Adaptation

- Visuo-motor adaptation
- Correct the person's sense of midline
Prism Adaptation

- Evidenced-based
- Decrease visual neglect
- Increase tactile sensitivity
- Increase motor coordination
- Short-term treatment
- Long-term functional recovery
Prism Adaptation

- Wheelchair navigation
- Reading
- Spatial dysgraphia
Therapy: Constraint-Induced Movement

- Forced use
- Time-intensive exercise of the weak arm
- Restraint of the strong arm with a mitt or a sling worn 90% of their waking hours
- Six hours of physiotherapy/day, 5 days/week
Constraint-Induced Movement Therapy Continued

• Wrist flexion of 20°
• Finger extension of 10° of two fingers
• The greater the motor movement, the more likely the patient will benefit from CIMT
• Not likely to benefit if the patient has complete paresis of the hand
Constraint-Induced Movement Therapy Tasks

- Tossing bean bags
- Reaching, grasping objects
- Stacking blocks
- Turning pages
- Flipping a card
- Writing
- Eating
CIMT: “Learned Non-Use” Phenomenon

- After a left-sided brain stroke, Right hemiparesis
- Weak right hand failure at ADLs
- Able left hand rewarded with success at ADLs
- Learns to stop using the weak right hand
- Despite neurological healing, no right hand function
“Learned Non-Use” Phenomenon: CIMT

• Practice every time with ADLs
CIMT criteria

• Initial treatment and enrollment for CIMT therapy is unclear
• Immediately after stroke, patient has not yet developed the “learned non-use” phenomenon
• Neurological recovery takes time
Evidence for Constraint-Induced Movement Therapy

- Small studies
- Six-months to one-year post-stoke
- 18-years post-stroke
Evidence for Constraint-Induced Movement Therapy

- Strength
- ROM
- Use in ADLs
Therapy: Contralesional hand stimulation

- Electromyography triggered neuromuscular electric stimulation
- Restoring function to hemiparetic limb show effective muscle contraction.
- E-stim has yet to prove that patients with neglect benefit
Mirror Therapy
Mental Imagery Training

- Theory driven Therapy
- Few studies
Neck muscle vibration

• Asymmetrical neck vibration
• Non-invasive
• Easy to apply
• Tested egocentric midline and tactile modes
• Combination treatment
• Induces lasting recovery in spatial neglect
Pharmaceutical approach

- Spatial working memory deficits - dopaminergic drugs
- Rhesus monkeys studies suggests that memories are modulated by dopamine D1 receptor agents
- Bromocriptine acts mainly on D2 dopamine receptors
Pharmaceutical: Dopaminergic therapy

- Convenient sampling
- Improved FIM scores
- Improved rehabilitation outcomes
- Reduced Unilateral spatial neglect
Pharmaceutical: Dopaminergic therapy

- Developing and promising
- Not standard care for neglect after stroke
- Standard: withhold anticholinergic medications, antidopaminergic, sedatives, hypnotics
Pharmacokinetic

- Convenient sampling
- Dopaminergic stimulation in patients with neglect
- 75% of the patients had significant improvement compared to placebo
Hospital Length of Stay

Very early mobilization, shorter hospital stay compared to patients who received standard of care.
Recovery and Measurable Goals

- Clinically relevant long-term benefits
- Visual scanning training with prism adaptation
- Neck muscle vibration and trunk rotation with visual scanning
Recovery and Measurable Goals

• Improve the patient’s competency
• Improve safety in dynamic and every day environment
• Pizzamiglio et al. (1992) demonstrated that visual scanning therapy, patients were able to describe common objects of activities of daily living.
• Improvement of wheelchair navigation was shown by Webster et al. (1984)
Evidence-based practice

• Improve care
• Implement evidenced-based practice
• Achieve excellent outcomes from rehab treatment
• Systematic implementation of procedures and treatments as standard of care
AVERT III (A very early rehabilitation therapy)

- Randomized, controlled trial, blind
- Mobilization within 24 hours of stroke onset
- Protocol: monitoring BP, HR, O2 Sats before each mobilization within the first 3 days of stroke
AVERT III (A very early rehabilitation therapy)

- VEM was to assist the patient to be upright and out of bed (sitting or standing as able) at least twice per day; in addition to their usual care, 6 days per week.
- Safe and feasible
- Early mobilization may be the simplest yet most important components of effective stroke unit care.
Evidenced-based

- Understanding recovery of neurons after a stroke
- Greater than 300 randomized controlled trials demonstrated evidence of hemispatial neglect treatment
Research Translation

• Previous studies have demonstrated treatment methods that are effective or proves their theoretical model

• However, very few of the studies were randomized and their selection method may have been jeopardized by bias
Research Translation

• Treatment practice needs to be supported by randomized studies
• Evidenced-based practice
References:


Questions?